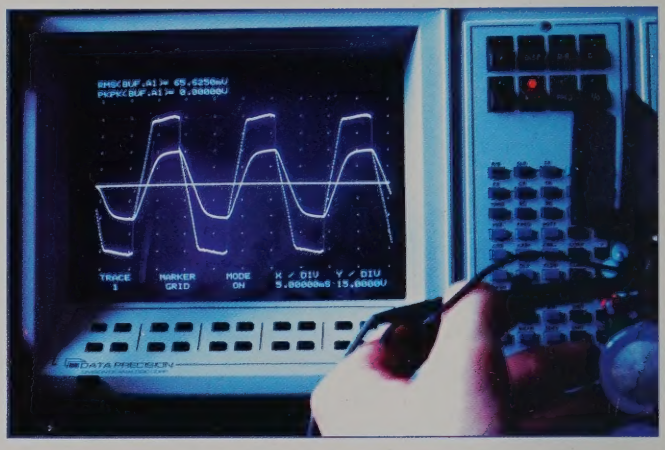
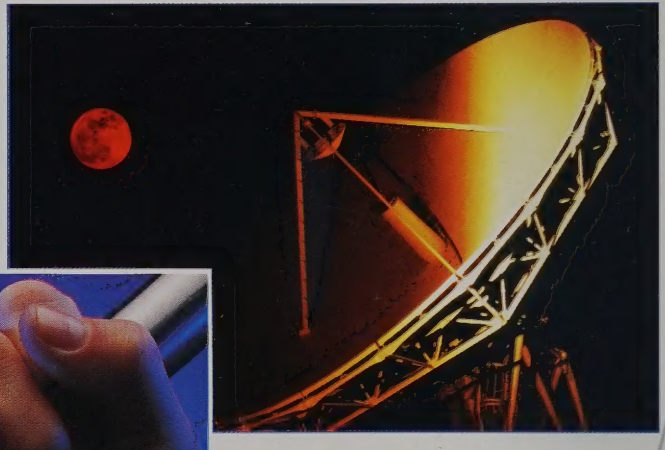
DG-96/97

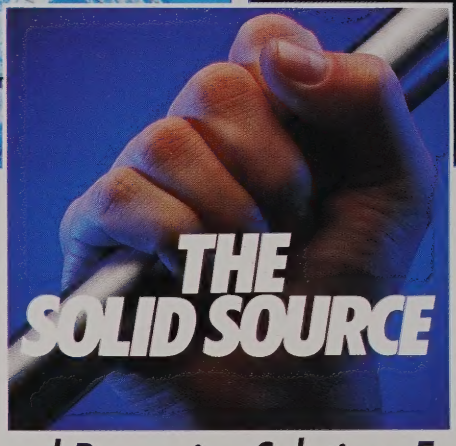
# RF/IF Designer's Guide

Mini-Circuits®

# MINI-CIRCUITS...
# THE SOLID SOURCE FOR RF/IF MICROWAVE COMPONENTS








## *Signal Processing Solutions For:*

*COMMUNICATIONS • WIRELESS & CELLULAR PRODUCTS • MEDICAL*

*TEST INSTRUMENTATION • RADAR • SATELLITE LINKS • RECEIVERS • PC ASSEMBLIES • COMPUTER*

*CABLE/TV BROADCASTING • AIRCRAFT & AEROSPACE • MILITARY*

*DIGITAL & ANALOG • DATA ACQUISITION • UHF/VHF TRANSMITTERS • TELEPHONY*

# QUALITY POLICY

Mini-Circuits quality policy is to provide products and services to our internal and external customers that will:

- **Meet stated requirements**
- **Exceed expectations**
- **Continuously be improved**

# CORPORATE VISION

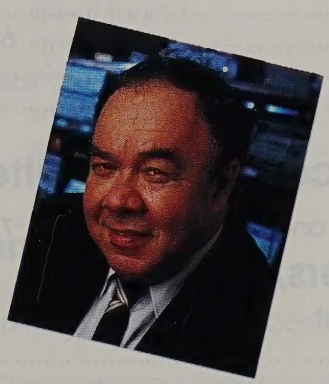
To continue to be a world preferred company for RF, IF and microwave products.

# MISSION STATEMENT

Our mission is to provide our customers with products of superior value while promoting growth and prosperity for our members, suppliers, community and company.

Harvey Kaylie

**HARVEY KAYLIE**
President
Mini-Circuits Laboratory
Brooklyn, New York



**Mini-Circuits®**

P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718)332-4661 *INTERNET* http://www. minicircuits. com

For detailed specs on all Mini-Circuits products refer to • 740- pg. HANDBOOK • INTERNET • THOMAS REGISTER • MICROWAVE PRODUCT DATA DIRECTORY • EEM

*CUSTOM PRODUCT NEEDS...Let Our Experience Work For You.*

# Table of Contents

## general information (section 0)


Corporate profile & Quality Policy ..... 2,3
How to use this guide ..... 6,7
Ordering and delivery information ..... 8,9
Partner program ..... 10
Partner program (terms & conditions) ..... 11
Model index ..... 12-15
Designers Kits ..... 16,17
Surface mount devices (actual size) ..... 18
Statistical process control ..... 28,29
Tape & reel packaging ..... 30
Device orientation ..... 31
Case style dimensions and outline drawings ..... 32-47
VSWR table ..... 69
Amplifier Selection Guide ..... 102,103
RF Transformer Technical Article ..... 170-173

Surface mount
- environmental specifications ..... 19
- understanding surface mount ..... 19
- questions and answers ..... 20,21
- glossary of terms ..... 21
- attaching surface mount components and reflow soldering ..... 22-24

Mini-Circuits Guarantees Quality
- environmental specifications
- quality control procedures
- high reliability, MIL & TX ..... 25-27

Applications support ..... 179
Worldwide Sales Offices / Distribution Centers ..... 180


## specifications and performance data*

### frequency mixers

surface mount


level 3 ..... 51
level 7 ..... 52,53
level 10 ..... 61
level 13 ..... 63
level 17 ..... 66


plug-in & coaxial


active ..... 48,49
level 7 ..... 54-59
level 10 ..... 60
level 13 ..... 62
level 17 ..... 64,65
level 23 ..... 67
level 27 ..... 68


### high power combiners/splitters


coaxial 2, 3, 4, 6 and 8 way ..... 70,71


### power splitters/combiners

surface mount


2 way - 0° ..... 73
2 way - 90° ..... 79
2 way - 180° ..... 80
3 way - 0° ..... 82
4 way - 0° ..... 85
5 way - 0° ..... 88
8 way - 0° ..... 90


plug-in & coaxial


2 way - 0° ..... 72,74,75
2 way - 0° resistive ..... 76
2 way - 90° ..... 77,78
2 way - 180° ..... 80
2 way - 0° / 180° ..... 81
3 way - 0° ..... 82,83
4 way - 0° ..... 84,86,87
5 way - 0° ..... 88
6 way - 0° ..... 89
8 way - 0° ..... 90,91
9 way - 0° ..... 92
10 way - 0° ..... 93
12 way - 0° ..... 94
16 way - 0° ..... 95
24 way - 0°, 48 way - 0° ..... 96


### impedance matching pad


coaxial models ..... 97


### terminations


coaxial models ..... 97


### attenuators

plug-in & coaxial


fixed ..... 98,100,101
attenuators/switches ..... 120,122
digital step ..... 123


surface mount


fixed ..... 99
attenuator/switches ..... 121





Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## amplifiers


amplifier selection guide ..... 102,103

surface mount

monolithic, microwave + data ..... 104,105
monolithic ..... 106,107

flat pack

monolithic ..... 108,109

plug-in & coaxial

low noise ..... 110,111
variable gain, high isolation ..... 112
low power, medium power ..... 113
medium higher power ..... 114
high power ..... 115
RF instrument amps ..... 116
very high power ..... 117
pulse amplifiers + data ..... 118,119


## directional couplers


surface mount

10 to 25.5 coupling ..... 124

plug-in & coaxial

high power ..... 125
6 to 30 dB coupling ..... 126,127


## filters


plug-in & coaxial

low pass ..... 128,130,131
bandpass ..... 132
low pass, flat time delay ..... 133
high pass ..... 134,135

surface mount

low pass ..... 129


## frequency doublers


plug-in & coaxial ..... 136,137
surface mount ..... 136


## limiters


plug-in & coaxial, +3 to 20 dBm input ..... 169


## phase shifters


plug-in ..... 139
surface mount ..... 139


## phase detectors


plug-in & coaxial ..... 138
surface mount ..... 138


## phase modulators


plug-in & coaxial

QPSK ..... 141
I&Q modulator ..... 142
I&Q demodulator ..... 144

surface mount

BPSK modulator ..... 140
I&Q modulator ..... 143
I&Q demodulator ..... 145


## switches


plug-in & coaxial

Pin diode with TTL drivers ..... 146
Pin diode SPST, SPDT ..... 147
GaAs, SPST, SPDT ..... 149

surface mount

GaAs, SPDT, SP4T ..... 148
GaAs, SPST, SPDT & Transfer ..... 150,151


## bias tees


surface mount ..... 152
plug-in & coaxial ..... 153


## voltage controlled oscillators


plug-in & coaxial

linear tuning ..... 154
dual output ..... 156

surface mount

linear tuning ..... 155
low noise ..... 157
data ..... 158-168


## transformers


surface mount ..... 174,175
plug-in & coaxial models ..... 176-178


*Performance curves and detailed data for Mini-Circuits newest products are contained on the Internet. See our Internet address on the opposite page. Our 740 page RF/IF Designer Handbook is also available. Write or call for your free, personal copies.

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# Using This Guide

Over 1000 Mini-Circuits IF/RF/Microwave Signal-Processing components are completely specified and described in this Guide. These Products are all available with guaranteed shipment of one week.

The large number of available models is offered so that the design engineer may select a model that closely fits the application requirement. In situations where there is a need for special electrical performance, mechanical configurations, environmental screening, or very low cost units, please contact our Applications Department. See page 179. In many cases, we produce special components in less than two weeks.

## table of contents

The table of contents on pages 4, 5 lists product sub groups with corresponding specification pages and product group technical information including articles.

## model number index

In each product group, model numbers are listed in alphanumeric order with page references to electrical specifications. All surface-mount models are highlighted with an indicator. See pages 12-15.

## SMD

Surface-mount devices are included in almost every product group. See model number index page 12-15. Product group specification sections indicate non-hermetic and tape and reel package availability. Technical articles are listed on pages 18 through 29.

## tape and reel packaging

Designers applying automated assembly procedures for surface-mount components will find a listing for tape width, reel size, package number, and number of devices on a reel; "footprints" for the various packages are shown on pages 30, 31.

## specifications

The specification pages in each section include, for every model, a photo, complete electrical specifications, price, page number for CAPD, schematic diagram, pin connections (for pc board models) or connector markings, and reference designations for the case style and outline drawing. Each model within a series has a case style and outline drawing reference. Comments applicable to the specifications are listed under Notes which appear for each page spread.

Using the latest industry criteria for specifying mixer and I and Q modulator performance, "typical" conversion loss has been deleted and replaced with x and $\sigma$ (sigma) average value and standard deviation of values for conversion loss. A discussion of these new parameter listings is given. See pages 28, 29.

**SURFACE MOUNT**

Available Tape & Reel

This "quick reference" headline and footer can be found on various product specification pages. It denotes that all the models featured on that page, or spread are surface mount and conveniently packaged on tape & reel.

**PARTNER PROGRAM**SM

A revolutionary new concept that lets you lower the cost of doing business in the 90's. A true partnership is described where your savings keep growing year in and year out. Details of the program and the easy procedure to join are simply explained. See pages 10, 11.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## case style outline drawings

Case Style and Outline Drawings include information on case dimensions, tolerances, case material and finish, bracket options and "footprint" sketches for pc board design using surface-mount units. See pages 32 through 47.

The information is arranged in tabular form with alphanumeric reference designations. Each alpha designation refers to a particular outline drawing. A photo of each case style is shown and designated on the model specification page.

## computer-automated performance data (CAPD)

This symbol signifies that computer-automated performance data, CAPD, is available. A significant number of pages in our Handbook are devoted to Mini-Circuits' exclusive computer-automated performance data. These pages describe the most complete detailed data and performance curves ever available on characteristics of over 1000 catalogue products. Page numbers referencing this data appear on each product specifications page and refer to Thomas Register catalog volume or our RF/IF Designer's Guide Handbook.

**ULTRA-REL™ MIXERS**
*5-YR. GUARANTEE**

This symbol identifies products that are manufactured with extra reliability. See page 26 for a complete explanation.

## prices

The prices shown are the U.S. unit list prices for the quantity indicated. For unit prices in higher quantities, and for a formal quote, contact our nearest distribution center, authorized local distributor, sales office or the factory. See back cover.

## ordering information and warranty

For warranty, terms of payment, shipping instructions, and one-week guaranteed shipping conditions. See pages 8 and 9.

## applications support/ technical assistance

For literature requests, assistance in selecting models, understanding model specifications, requesting additional model performance data, contact our Applications Engineering Department. See page 179.

## sales assistance

For assistance in purchasing products, obtaining quotes, opening up an account, requesting order status information, assistance in obtaining same or next day delivery, contact our Sales Department.

## NSN numbers

Specification pages contain a listing of Mini-Circuits' models that have been assigned a National Stock Number (NSN).

## listing of reps, authorized distributors distribution centers

A complete list of Mini-Circuits' sales representatives, local distributors, and major Distribution Centers puts you in immediate contact with our Sales Support team to answer questions, assist in component selection, and expedite orders. See back cover.

**In Stock... Immediate Delivery**

For Custom Versions Of Standard Models Consult Our Applications Dept.

## ordering and delivery information

Refer to the rep listing in this handbook for Mini-Circuits worldwide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

*Federal supply code: 15542*

## how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data. Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.

Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes. Minimum order $50.00.

## shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used. For air shipments, Mini-Circuits has arranged for substantial discounts with carriers.

## terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. We also accept most major credit cards. If prepaying, please include freight.

## warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.

Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty. SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMERS' INTENDED USE. BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER.

Equipment shipped F.O.B. Mini-Circuits' plant or Distribution Center shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment. A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special indirect or consequential damages.

***For U.S. Customers***

To provide superior customer convenience and fast delivery, our Distribution Center is open 12 hours a day (8AM to 8PM for East coast and 5AM to 5PM for West Coast customers). For West Coast orders, second day air service is offered at UPS ground rates. And, of course, all prices are the same as quoted from the factory.

***For European Customers***

To provide superior customer convenience, our Distribution Center in the UK (Wharf Rd., Frimley Green, Camberley, Surrey, GU16 6LF) is open from 8:30AM to 5:30PM. And, exclusive of duty and freight, all prices are the same as quoted from Mini-Circuits' factory.

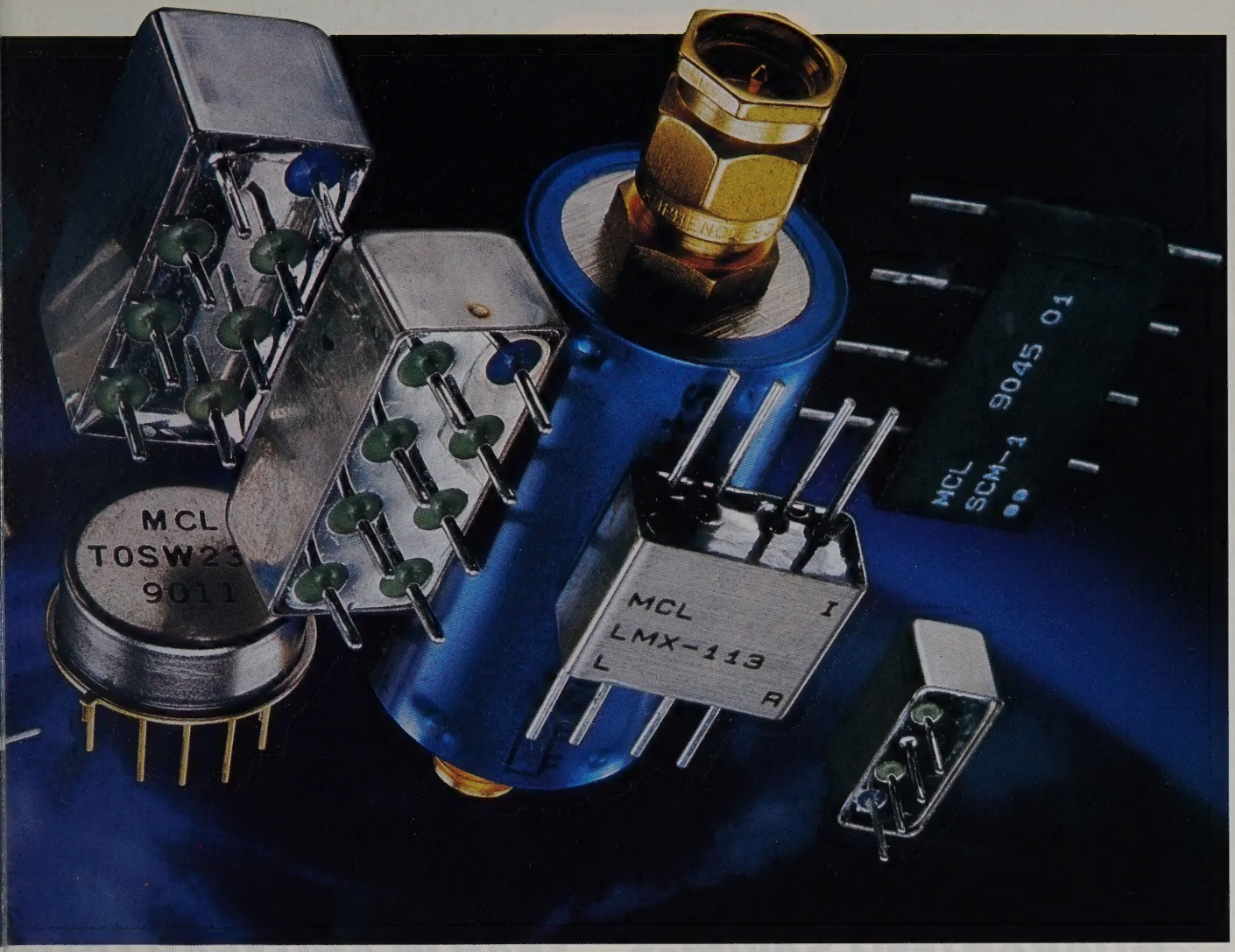
# ALL MINI-CIRCUITS SHIPPED WITHIN

Eliminate weeks or even months of shipment delays for RF/IF signal-processing components...just one phone call to a Mini-Circuits' Distribution Center guarantees shipment within one week.

All Mini-Circuits' components listed in the latest published catalog, in all configurations, mounting options, and connector types will be processed and shipped within one week after an order is received, or if the order calls for scheduled assignments, we will ship on or before the due date. If we're late subject to the Conditions of Guarantee, we'll give a discount of 1% per day from your bill (maximum 25%, as allowed by law); but don't count on this discount since we intend to meet each and every scheduled shipment. Although we guarantee one-week turnaround, two days is our target and for rush orders only one day.

What makes this rapid turnaround possible? First, fast manufacturing throughput achieved through powerful statistical process-control techniques coupled with the latest computer-automated production and test equipment. Second, a worldwide distribution network with major Distribution Centers in the U.S. and England.

Guaranteed order processing is another expression of Mini-Circuits' dedicated effort for world-class quality...meeting and exceeding customers' expectations. Write, phone, or fax your order and be confident that it will be shipped on time, every time by Mini-Circuits.




# RF/IF CATALOG PRODUCTS ONE-WEEK... GUARANTEED!

## DISTRIBUTION CENTERS

**NORTH AMERICA**
Mini-Circuits
NEW YORK
8AM-5:30PM EST
(phone) 800 247-6343
(phone) 718 934-4500
(fax) 718 332-4661

MISSOURI
9AM-8PM EST
(phone) 800 654-7949
(phone) 417 335-5935
(fax) 417 335-5945

**EUROPE**
Mini-Circuits Europe
Registered in England No. 1419461,
Dale Electronics Ltd.
A Subsidiary of Mini-Circuits

Registered Office Dale House,
Wharf Road, Frimley Green Camberley,
Surrey GU16 6LF, England

(phone) 44-1252-835094
(fax) 44-1252-837010

CREDIT CARDS WELCOME

## *Conditions of Guarantee*

- DISCOUNT: 1% per day will be discounted from the bill (maximum 25%, as allowed by law) if components listed in the latest catalog are not shipped within one week after an order is placed or if a scheduled order is shipped after the due date, subject to the Conditions of Guarantee.
- ORDER PLACEMENT—guarantee applies only to orders placed with Distribution Center.
- ORDER REQUIREMENT—guarantee starts after all details of the purchase order are received complete.
- SHIPMENT TIME—guarantee applies for work days Monday through Friday, holidays excluded.
- TRANSPORTATION—does not apply to situations where shipping is inhibited due to strikes, weather, or conditions beyond our control.
- GOVERNMENT REGULATIONS—does not apply to purchase orders inhibited by government rules, regulations, export licenses, and/or customs approval.
- QUANTITIES—guarantee applies to normal distribution quantities, which vary according to product line.
- CREDIT RATING—guarantee limited to companies with approved credit rating at time of shipment.
- LETTERS OF CREDIT—guarantee limited to meeting terms of LC.

AMERICAN EXPRESS VISA ACCESS MASTER CARD EUROCARD

finding new ways...
setting higher standards

**Mini-Circuits**

P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

*Distribution Centers* NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



F144 REV. B

# GUARANTEED SAVINGS...YEAR IN AND YEAR OUT!

### How the program works

Wouldn't it be nice to plan next years budget based on costs that decrease instead of increase? When you're a member of Mini-Circuits new Partner Program℠, you can do just that! It's as easy as 2 + 2 = 4...here's how it works.

The minute you join the partner program, the first time you purchase a Mini-Circuits model, the quantity price you pay is based on the sum of all your previous yearly purchases of that model. If you purchased 200 of a particular unit last year, and need another 200 units this year, the price you pay today would be based on a 400 unit quantity discount!

Yes, with the Partner Program℠, your quantity discounts accumulate year after year as your total purchases jump from one quantity discount bracket to another.

### Now that's guaranteed savings!

With Mini-Circuits Partner Program℠ you can enjoy a lifetime of volume quantity price reductions on all our catalog and most of our custom products.

### The Partner Program℠ makes sense

Today, everybody is talking about the highly competitive business environment and the global challenges of the 90's. In typical Mini-Circuits tradition, we're not talking...we're taking action.

The Partner Program℠ is our way of sharing risks and earning the rewards of doing business with you.

Mini-Circuits is committed to a total partnership for improving quality and reducing manufacturing thru-put time. The end result, lower costs. As Partners, we both share in these savings.

*That's what true partnership is all about.*

### Joining the Partner Program℠

The program is limited to qualified customers at no cost or obligation. Simply request a Partner Program℠ kit to receive information on this revolutionary program.

We'll take care of all the details and manage the statistics for your account.

You can place your orders in the usual manner with Mini-Circuits or any Mini-Circuits Distribution Center. Your purchases will be tallied and tracked in the Mini-Circuits computer. In 1996 you will be eligible to receive automatic discounts based on your purchases starting from 1990.

JOIN THE PARTNER PROGRAM TODAY !

See Details

**Mini-Circuits®**

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

***Distribution Centers*** NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

For detailed specs on all Mini-Circuits products refer to • THOMAS REGISTER Vol. 23 • MICROWAVES PRODUCT DIRECTORY • EEM • MINI-CIRCUITS' 740-pg HANDBO(

CUSTOM PRODUCT NEEDS... ***Let Our Experience Work For You.***



F 172-Rev. Orig

# Mini-Circuits

# PARTNER PROGRAM℠

## TERMS & CONDITIONS

This program is offered to qualified customers for the purpose of maintaining a mutually beneficial long term relationship.

As a participant of this program, you will share in the results of Mini-Circuits' commitment to quality by earning cumulative annual quantity price break reductions on all of your Mini-Circuits purchases.[1]

As the cumulative total enters into a higher quantity price break, the unit price of your present purchase is lowered, and it never stops. You can enjoy a lifetime of volume quantity price reductions on all of our catalog, and most of our custom products.

For a particular purchase of quantity C in the present year, the price shall correspond to quantity A according to the following formula.

$$QTY\ A = QTY\ B + QTY\ C$$

where QTY B = cumulative annual quantity purchased in preceding years as of January 1, 1990.

### joining the program

Qualified customers automatically join the Partner Program by making a purchase of a Mini-Circuits model[2] from a Mini-Circuits distribution center, authorized local distributor, or from the factory direct.

### qualified customers

The program is limited to original users. Companies reselling Mini-Circuits products do not qualify. Original users shall mean approved companies, universities, schools, organizations, a division or subsidiary of a corporation, and a department or location of a government agency. For corporations issuing a corporate contract to Mini-Circuits, a division of the corporation may combine quantities purchased by other divisions for cumulative total quantity calculations. In absence of a corporate contract, each division must join the Partner Program℠ individually.

### maintaining qualification

A good credit standing with Mini-Circuits is a criteria to remain a participant of the program.

### purchase location eligibility

Purchases from Mini-Circuits or a Mini-Circuits distribution center qualify for the program. Purchases from an authorized participating distributor qualify for the program when documentation of purchase is supplied to Mini-Circuits.

### product eligibility

All catalog models and most special models are included in the program.

### product ineligibility

Purchases made for the following do not qualify for the program: special testing, lot testing, serializing, source inspections, and qualification testing. Furthermore, purchases during special promotions or for multi-year or special contracts do not qualify. Highly specialized custom designed models may not be included in the program. Please consult with the Partner Program manager.

### purchase quantities

Quantities credited to the program include only the net quantity of each model shipped to the customer in a specific calendar year. Different models may not be combined.

### minimum purchase quantities

The base year quantity equals the total cumulative consecutive annual quantity purchased in preceding years as of January 1, 1990. However, if the quantity purchased for a model in a year is less than 2% of the quantity purchased in the previous year, then the cumulative total for the previous years shall revert to zero, i.e., base year quantity equals zero.

### partner program changes

Mini-Circuits reserves the right to make changes to the program without prior notice.

### partner program validity

The partner program is void where prohibited by law.

[1]Subject to the provisions of the terms and conditions given herein.
[2]All catalogs and most special products are eligible.

# Model Index

● Dot indicates surface mount models.

## mixers


| model | pages |
|---|---|
| ASK-1 | 56 |
| ● ASK-1-KK81 | 52 |
| ASK-2 | 56 |
| ● ASK-2-KK81 | 52 |
| GRA-1 | 54 |
| GRA-1H | 64 |
| GRA-3 | 54 |
| GRA-3H | 64 |
| GRA-6 | 54 |
| GRA-6H | 64 |
| GRA-8 | 54 |
| ● JMS-1 | 52 |
| ● JMS-1LH | 61 |
| ● JMS-1MH | 63 |
| ● JMS-1H | 66 |
| ● JMS-2 | 52 |
| ● JMS-2H | 66 |
| ● JMS-2L | 51 |
| ● JMS-2LH | 61 |
| ● JMS-2MH | 63 |
| ● JMS-2W | 52 |
| ● JMS-5 | 52 |
| ● JMS-5LH | 61 |
| ● JMS-5MH | 63 |
| ● JMS-5H | 66 |
| ● JMS-11X | 52 |
| ● JYM-20H | 52 |
| ● JYM-28H | 66 |
| ● JYM-30H | 66 |
| LMX-3 | 57 |
| LMX-113 | 57 |
| LMX-123 | 60 |
| LMX-123MH | 62 |
| LMX-124 | 57 |
| LMX-125MH | 62 |
| LMX-148 | 60 |
| LMX-149 | 57 |
| LMX-156 | 57 |
| LMX-1481 | 60 |
| ● LRMS-1 | 52 |
| ● LRMS-1H | 66 |
| ● LRMS-1LH | 61 |
| ● LRMS-1MH | 63 |
| ● LRMS-1W | 52 |
| ● LRMS-1WH | 66 |
| ● LRMS-2 | 52 |
| ● LRMS-2D | 52 |
| ● LRMS-2H | 66 |
| ● LRMS-2L | 51 |
| ● LRMS-2LH | 61 |
| ● LRMS-2MH | 63 |
| ● LRMS-2U | 52 |
| ● LRMS-2UH | 66 |
| ● LRMS-5 | 52 |
| ● LRMS-5H | 66 |
| ● LRMS-5L | 51 |
| ● LRMS-5LH | 61 |
| ● LRMS-5MH | 63 |
| ● LRMS-11A | 52 |
| ● LRMS-860 | 52 |
| RAY-1 | 67 |
| RAY-2 | 67 |
| RAY-3 | 67 |
| RAY-6 | 67 |
| RAY-6U | 67 |
| RAY-11 | 67 |
| ● RMS-1 | 52 |
| ● RMS-1BM | 52 |
| ● RMS-1H | 66 |
| ● RMS-1LH | 61 |
| ● RMS-1MH | 63 |
| ● RMS-1W | 52 |
| ● RMS-1WH | 66 |
| ● RMS-2 | 52 |
| ● RMS-2D | 52 |
| ● RMS-2H | 66 |
| ● RMS-2L | 51 |
| ● RMS-2LH | 61 |
| ● RMS-2MH | 63 |
| ● RMS-2U | 52 |
| ● RMS-2UH | 66 |
| ● RMS-2UMH | 63 |
| ● RMS-5 | 52 |
| ● RMS-5H | 66 |
| ● RMS-5L | 51 |
| ● RMS-5LH | 61 |
| ● RMS-5MH | 63 |
| ● RMS-11A | 52 |
| ● RMS-11F | 52 |
| ● RMS-11X | 52 |
| ● RMS-25MH | 63 |
| ● RMS-30 | 52 |
| ● RMS-42MH | 63 |
| ● RMS-860 | 52 |
| ROK-186MH | 62 |
| ROK-2500LH | 60 |
| ROSE-1 | 55 |
| ROSE-2 | 55 |
| SAM-1 | 55 |
| SAM-2 | 55 |
| SAM-3 | 55 |
| SAM-4 | 55 |
| SAM-5 | 55 |
| SAY-1 | 67 |
| SAY-2 | 67 |
| SAY-11 | 67 |
| SBL-1 | 54 |
| SBL-1-1 | 54 |
| SBL-1-1LH | 60 |
| SBL-1LH | 60 |
| SBL-1MH | 62 |
| SBL-1X | 54 |
| SBL-1XLH | 60 |
| SBL-1Z | 54 |
| SBL-1ZMH | 62 |
| SBL-2LH | 60 |
| SBL-3 | 54 |
| SBL-3LH | 60 |
| SBL-11 | 54 |
| SBL-11LH | 60 |
| SBL-173H | 64 |
| SBL-173SH | 64 |
| SBL-2500H | 64 |
| ● SCM-1 | 53 |
| ● SCM-1LH | 61 |
| ● SCM-2 | 53 |
| ● SCM-2LH | 61 |
| ● SCM-5 | 53 |
| ● SCM-5LH | 61 |
| ● SCM-2500 | 53 |
| ● SCM-2500LH | 61 |
| SIMA-5 | 54 |
| SIMA-5H | 64 |
| SIMA-5MH | 62 |
| ● SKY-5G | 53 |
| ● SKY-7G | 53 |
| ● SKY-53R | 53 |
| ● SKY-53HR | 66 |
| ● SKY-53LHR | 61 |
| ● SKY-53MHR | 63 |
| ● SKY-60 | 53 |
| ● SKY-60H | 66 |
| ● SKY-60LH | 61 |
| ● SKY-60MH | 63 |
| SRA-1 | 54 |
| SRA-1-1 | 54 |
| SRA-1H | 64 |
| SRA-1MH | 62 |
| SRA-1TX | 54 |
| SRA-1W | 54 |
| SRA-1WH | 64 |
| SRA-11 | 54 |
| SRA-11H | 64 |
| SRA-12 | 54 |
| SRA-149 | 54 |
| SRA-173H | 64 |
| SRA-173SH | 64 |
| SRA-2 | 54 |
| SRA-2CM | 54 |
| SRA-2CR | 60 |
| SRA-2H | 64 |
| SRA-215 | 60 |
| SRA-220 | 60 |
| SRA-2000 | 54 |
| SRA-2010MH | 62 |
| SRA-2400 | 54 |
| SRA-2500SH | 64 |
| SRA-3 | 54 |
| SRA-3H | 64 |
| SRA-3MH | 62 |
| SRA-3500 | 54 |
| SRA-4 | 54 |
| SRA-5 | 54 |
| SRA-6 | 54 |
| SRA-6H | 64 |
| SRA-8 | 54 |
| ● SYM-2 | 53 |
| ● SYM-11 | 53 |
| ● SYM-11H | 66 |
| ● SYM-11LH | 61 |
| ● SYM-11MH | 63 |
| ● SYM-12 | 53 |
| ● SYM-860 | 53 |
| ● SYM-2500 | 53 |
| TAK-1H | 64 |
| TAK-1WH | 64 |
| TAK-3H | 64 |
| TAK-5 | 55 |
| TAK-5R | 55 |
| TAK-6 | 55 |
| TAK-6R | 55 |
| TAK-7 | 55 |
| TFM-1H | 64 |
| TFM-1MH | 62 |
| TFM-2 | 56 |
| TFM-2H | 64 |
| TFM-2LH | 60 |
| TFM-2P | 56 |
| TFM-3 | 56 |
| TFM-3H | 64 |
| TFM-3MH | 62 |
| TFM-4 | 56 |
| TFM-4H | 64 |
| TFM-5 | 56 |
| TFM-11 | 56 |
| TFM-12 | 56 |
| TFM-12MH | 62 |
| TFM-15 | 60 |
| TFM-42MH | 62 |
| TFM-150 | 60 |
| TFM-2400 | 56 |
| TFM-4300 | 56 |
| TSM-1 | 55 |
| TSM-2 | 55 |
| TSM-3 | 55 |
| TSM-5 | 55 |
| TUF-1 | 57 |
| TUF-1H | 64 |
| ● TUF-1HSM | 66 |
| TUF-1LH | 60 |
| ● TUF-1LHSM | 61 |
| TUF-1MH | 62 |
| ● TUF-1MHSM | 63 |
| ● TUF-1SM | 53 |
| TUF-2 | 57 |
| TUF-2H | 64 |
| ● TUF-2HSM | 66 |
| TUF-2LH | 60 |
| ● TUF-2LHSM | 61 |
| TUF-2MH | 62 |
| ● TUF-2MHSM | 63 |
| ● TUF-2SM | 53 |
| TUF-3 | 57 |
| TUF-3H | 64 |
| ● TUF-3HSM | 66 |
| TUF-3LH | 60 |
| ● TUF-3LHSM | 61 |
| TUF-3MH | 62 |
| ● TUF-3MHSM | 63 |
| ● TUF-3SM | 53 |
| TUF-5 | 57 |
| TUF-5H | 64 |
| ● TUF-5HSM | 66 |
| TUF-5LH | 60 |
| ● TUF-5LHSM | 61 |
| TUF-5MH | 62 |
| ● TUF-5MHSM | 63 |
| ● TUF-5SM | 53 |
| TUF-5X | 57 |
| ● TUF-5XSM | 53 |
| TUF-11A | 57 |
| TUF-11AH | 64 |
| ● TUF-11AHSM | 66 |
| TUF-11ALH | 60 |
| ● TUF-11ALHSM | 61 |
| TUF-11AMH | 62 |
| ● TUF-11AMHSM | 63 |
| ● TUF-11ASM | 53 |
| TUF-860 | 57 |
| TUF-860H | 64 |
| ● TUF-860HSM | 66 |
| TUF-860LH | 60 |
| ● TUF-860LHSM | 61 |
| TUF-860MH | 62 |
| ● TUF-860MHSM | 63 |
| ● TUF-860SM | 53 |
| TUF-2500MH | 62 |
| ● TUF-2500MHSM | 63 |
| UNCL-L1 | 49 |
| UNCL-L1H | 49 |
| UNCL-R1 | 48 |
| UNCL-R1H | 48 |
| UNCL-X1 | 48 |
| UNCL-X1MH | 48 |
| VAY-1 | 68 |
| ZAD-1 | 58 |
| ZAD-1-1 | 58 |
| ZAD-1H | 65 |
| ZAD-1SH | 65 |
| ZAD-1W | 58 |
| ZAD-1WH | 65 |
| ZAD-1WSH | 65 |
| ZAD-2 | 58 |
| ZAD-2H | 65 |
| ZAD-3 | 58 |
| ZAD-3H | 65 |
| ZAD-3SH | 65 |
| ZAD-4 | 58 |
| ZAD-6 | 58 |
| ZAD-8 | 58 |
| ZAD-11 | 58 |
| ZAD-11H | 65 |
| ZAD-12 | 58 |
| ZAM-42 | 59 |
| ZAY-1 | 67 |
| ZAY-2 | 67 |
| ZAY-3 | 67 |
| ZEM-M2TMH | 62 |
| ZEM-2B | 59 |
| ZEM-4300 | 59 |
| ZEM-4300MH | 62 |
| ZFM-1H | 65 |
| ZFM-1W | 59 |
| ZFM-2 | 59 |
| ZFM-2H | 65 |
| ZFM-3 | 59 |
| ZFM-3H | 65 |
| ZFM-4 | 59 |
| ZFM-4H | 65 |
| ZFM-5X | 59 |
| ZFM-11 | 59 |
| ZFM-12 | 59 |
| ZFM-15 | 60 |
| ZFM-150 | 60 |
| ZFM-2000 | 59 |
| ZFM-4212 | 59 |
| ZFY-1 | 67 |
| ZFY-2 | 67 |
| ZFY-11 | 67 |
| ZLW-1 | 58 |
| ZLW-1W | 58 |
| ZLW-1-1 | 58 |
| ZLW-1H | 65 |
| ZLW-1SH | 65 |
| ZLW-1WH | 65 |
| ZLW-1WSH | 65 |
| ZLW-2 | 58 |
| ZLW-2H | 65 |
| ZLW-3 | 58 |
| ZLW-3H | 65 |
| ZLW-3SH | 65 |
| ZLW-5 | 58 |
| ZLW-6 | 58 |
| ZLW-8 | 58 |
| ZLW-11 | 58 |
| ZLW-11H | 65 |
| ZLW-12 | 58 |
| ZLW-186MH | 62 |
| ZMX-7GHR | 65 |
| ZMX-7GLHR | 60 |
| ZMX-7GMH | 62 |
| ZMX-7GMHR | 62 |
| ZMX-7GR | 58 |
| ZMX-8GH | 65 |
| ZMX-8GLH | 60 |
| ZMX-10G | 58 |
| ZMY-1 | 67 |
| ZMY-2 | 67 |
| ZMY-3 | 67 |
| ZP-1 | 58 |
| ZP-1H | 65 |
| ZP-1LH | 60 |
| ZP-1MH | 62 |
| ZP-2 | 58 |
| ZP-2H | 65 |
| ZP-2LH | 60 |
| ZP-2MH | 65 |
| ZP-3 | 58 |
| ZP-3H | 65 |
| ZP-3LH | 60 |
| ZP-3MH | 62 |
| ZP-5 | 58 |
| ZP-5H | 65 |
| ZP-5LH | 60 |
| ZP-5MH | 62 |
| ZP-5X | 58 |
| ZP-11A | 58 |
| ZP-11AH | 65 |
| ZP-11ALH | 60 |
| ZP-11AMH | 62 |
| ZP-860 | 58 |
| ZP-860H | 65 |
| ZP-860LH | 60 |
| ZP-860MH | 62 |
| ZP-10514 | 58 |




Mini-Circuits®

*INTERNET* http://www.minicircuits.com

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

***Distribution Centers*** NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## power splitters / combiners


| model | pages |
|---|---|
| IZY2PD-64 | 74 |
| IZY2PD-86 | 74 |
| ● JCPS-8-850-75 | 90 |
| ● JPS-2-1N | 73 |
| ● JPS-2-1W | 73 |
| ● JPS-2-4 | 73 |
| ● JPS-2-900 | 73 |
| ● JPS-3-1 | 82 |
| ● JPS-3-1W | 82 |
| ● JSPQ-1875W | 79 |
| ● JSPQW-100 | 79 |
| ● JYPS-2-4-75 | 73 |
| LPS-109 | 72 |
| ● LRPQ-70 | 79 |
| ● LRPQ-700 | 79 |
| ● LRPQ-980 | 79 |
| ● LRPS-2-1 | 73 |
| ● LRPS-2-1-75 | 73 |
| ● LRPS-2-1W-75 | 73 |
| ● LRPS-2-4 | 73 |
| ● LRPS-2-11 | 73 |
| ● LRPS-2-25 | 73 |
| ● LRPS-2-980 | 73 |
| ● LRPS-3-1 | 82 |
| ● LRPS-3-850 | 82 |
| MSC-2-1 | 72 |
| MSC-2-1W | 72 |
| MSC-2-5 | 72 |
| MSC-2-11 | 72 |
| PMT-1 | 81 |
| PMT-1-75 | 81 |
| PQW-2-90 | 78 |
| PQW-2-270 | 78 |
| PRSC-2050 | 76 |
| PSC-2-1 | 72 |
| PSC-2-1-75 | 72 |
| PSC-2-1-75A | 72 |
| PSC-2-1V-75 | 72 |
| PSC-2-1W | 72 |
| PSC-2-1W-75 | 72 |
| PSC-2-2 | 72 |
| PSC-2-2-75 | 72 |
| PSC-2-4 | 72 |
| PSC-2-4-752 | 72 |
| PSC-2-5 | 72 |
| PSC-2-11 | 72 |
| PSC-2-45 | 72 |
| PSC-2-500-1W | 72 |
| PSC-2-960-1W | 72 |
| PSC-2-1000 | 72 |
| PSC-2375 | 72 |
| PSC-3-1 | 82 |
| PSC-3-1A | 82 |
| PSC-3-1-75 | 82 |
| PSC-3-1-75-2 | 82 |
| PSC-3-1W | 82 |
| PSC-3-2 | 82 |
| PSC-3-13 | 82 |
| PSC-3-13-39 | 82 |
| PSC-4-1 | 84 |
| PSC-4-1-75 | 84 |
| PSC-4-1W | 84 |
| PSC-4-1W-75 | 84 |
| PSC-4-3 | 84 |
| PSC-4A-1W-75 | 84 |
| PSC-4A-4 | 84 |
| PSC-4A-475 | 84 |
| PSC-4-5 | 84 |
| PSC-4-6 | 84 |
| PSC-5-1 | 88 |
| PSC-5-1-75 | 88 |
| PSC-5-2 | 88 |
| PSC-6-1 | 89 |
| PSC-6-1-75 | 89 |
| PSC-8-1 | 90 |
| PSC-8-1W | 90 |
| PSC-8-1-75 | 90 |
| PSC-8-6 | 90 |
| PSC-8A-4 | 90 |
| PSC-8A4-75 | 90 |
| PSC-9-1 | 92 |
| PSC-10-1 | 93 |
| PSC-12-1 | 94 |
| PSCJ-2-1 | 80 |
| PSCJ-2-1-75 | 80 |
| PSCJ-2-1W | 80 |
| PSCJ-2-2 | 80 |
| PSCQ-2-0.455 | 78 |
| PSCQ-2-1.25 | 78 |
| PSCQ-2-1.5 | 78 |
| PSCQ-2-3.4 | 78 |
| PSCQ-2-4.0 | 78 |
| PSCQ-2-6.4 | 78 |
| PSCQ-2-7.5 | 78 |
| PSCQ-2-8 | 78 |
| PSCQ-2-10.5 | 78 |
| PSCQ-2-13 | 78 |
| PSCQ-2-14 | 78 |
| PSCQ-2-17.5 | 78 |
| PSCQ-2-21.4 | 78 |
| PSCQ-2-32 | 78 |
| PSCQ-2-26 | 78 |
| PSCQ-2-40 | 78 |

| model | pages |
|---|---|
| PSCQ-2-50 | 78 |
| PSCQ-2-60 | 78 |
| PSCQ-2-70 | 78 |
| PSCQ-2-70N | 78 |
| PSCQ-2-85A | 78 |
| PSCQ-2-90 | 78 |
| PSCQ-2-120 | 78 |
| PSCQ-2-160 | 78 |
| PSCQ-2-180 | 78 |
| PSCQ-2-250 | 78 |
| PSCQ-2-300 | 78 |
| PSCQ-2-400 | 78 |
| PSCQ-2-450 | 78 |
| PSCQ-2-550 | 78 |
| PSCQ-2-1000 | 78 |
| ● RPQ-820 | 79 |
| ● RPQ-1495 | 79 |
| ● SCP-2-1 | 73 |
| ● SCP-2-1A | 73 |
| ● SCP-3-1 | 82 |
| ● SCP-4-1 | 85 |
| ● SCP-4-1W | 85 |
| ● SCP-4-1W-75 | 85 |
| ● SCP-4-4 | 85 |
| ● SCP-4-4-75 | 85 |
| ● SCP-5-1 | 88 |
| ● SCPJ-2-1W-75 | 80 |
| ● SCPJ-2-750-75 | 80 |
| ● SCPQ-10.5 | 79 |
| ● SCPQ-21.4 | 79 |
| ● SCPQ-50 | 79 |
| ● SCPQ-60 | 79 |
| ● SCPQ-85C | 79 |
| ● SCPQ-90 | 79 |
| ● SCPQ-150 | 79 |
| ● SCPQ-180 | 79 |
| ● SCPQ-400 | 79 |
| ● SYPQ-21.4 | 79 |
| ● SYPQ-70 | 79 |
| ● SYPQ-113-1 | 79 |
| ● SYPS-2-1 | 73 |
| T05SC-2-1 | 72 |
| T05SC-110 | 72 |
| TSC-2-1 | 72 |
| TSC-2-1W | 72 |
| ZAPD-1 | 75 |
| ZAPD-2 | 75 |
| ZAPD-4 | 75 |
| ZAPD-21 | 75 |
| ZAPD-50 | 75 |
| ZAPD-50W | 75 |
| ZAPD-1750 | 75 |
| ZAPDJ-2 | 80 |
| ZAPDQ-2 | 77 |
| ZAPDQ-4 | 77 |
| ZA3PD-1 | 83 |
| ZA3PD-1.5 | 83 |
| ZA3PD-2 | 83 |
| ZA3PD-4 | 83 |
| ZA4PD-2 | 87 |
| ZA4PD-4 | 87 |
| ZBSC-413 | 86 |
| ZBSC-611 | 89 |
| ZBSC-615 | 89 |
| ZB4PD-4 | 87 |
| ZB4PD-42 | 87 |
| ZB4PD-1750-75 | 87 |
| ZB4PD1-8.4 | 87 |
| ZB4PD1-500-75 | 87 |
| ZB4PD1-930 | 87 |
| ZB4PD1-930W | 87 |
| ZB4PD1-2000 | 87 |
| ZB6PD-1700 | 89 |
| ZB6PD-2 | 89 |
| ZB6PD1-900 | 89 |
| ZB6PD1-960 | 89 |
| ZB6PD1-1900 | 89 |
| ZB8PD-1 | 91 |
| ZB8PD-2 | 91 |
| ZB8PD-4 | 91 |
| ZB8PD-8.4 | 91 |
| ZB8PD-2000 | 91 |
| ZCSC-3-R3 | 83 |
| ZCSC-4-1W | 86 |
| ZCSC-8-1 | 91 |
| ZC2PD-900 | 75 |
| ZC4PD-900 | 87 |
| ZC6PD-960 | 89 |
| ZC6PD-960W | 89 |
| ZC6PD-1900 | 89 |
| ZC6PD-1900W | 89 |
| ZC8PD-900 | 91 |
| ZC9PD-1000 | 92 |
| ZC10PD-900 | 93 |
| ZC10PD-900W | 93 |
| ZC16PD-900 | 95 |
| ZC16PD-960 | 95 |
| ZC16PD-960W | 95 |
| ZC16PD-1900 | 95 |
| ZC16PD-1900W | 95 |
| ZC16PD-2185 | 95 |
| ZESC-2-11 | 74 |
| ZFRSC-42 | 76 |

| model | pages |
|---|---|
| ZFRSC-2050 | 76 |
| ZFRSC-2075 | 76 |
| ZFSC-2-1 | 74 |
| ZFSC-2-1-75 | 74 |
| ZFSC-2-1W | 74 |
| ZFSC-2-1W-75 | 74 |
| ZFSC-2-2 | 74 |
| ZFSC-2-4 | 74 |
| ZFSC-2-5 | 74 |
| ZFSC-2-6 | 74 |
| ZFSC-2-6-75 | 74 |
| ZFSC-2-9G | 74 |
| ZFSC-2-10G | 74 |
| ZFSC-2-11 | 74 |
| ZFSC-2-2500 | 74 |
| ZFSC-3-1 | 83 |
| ZFSC-3-1W | 83 |
| ZFSC-3-4 | 83 |
| ZFSC-3-13 | 83 |
| ZFSC-4-1 | 86 |
| ZFSC-4-1W | 86 |
| ZFSC-4-2-75-1 | 86 |
| ZFSC-4-3 | 86 |
| ZFSC-4375 | 86 |
| ZFSC-4-175 | 86 |
| ZFSC-5-1 | 88 |
| ZFSC-6-1 | 89 |
| ZFSC-6-1-75 | 89 |
| ZFSC-6-110 | 89 |
| ZFSC-8-1 | 91 |
| ZFSC-8-1-75 | 91 |
| ZFSC-82-75 | 91 |
| ZFSC-8375 | 91 |
| ZFSC-8-4 | 91 |
| ZFSC-84-75 | 91 |
| ZFSC-8-6 | 91 |
| ZFSC-8-43 | 91 |
| ZFSC-10-1 | 93 |
| ZFSC-12-1 | 94 |
| ZFSC-12-1-75 | 94 |
| ZFSC-12-11 | 94 |
| ZFSC-12-175 | 94 |
| ZFSC-16-1 | 95 |
| ZFSC-16-1-75 | 95 |
| ZFSC-16-3 | 95 |
| ZFSC-16-12 | 95 |
| ZFSC-16-675 | 95 |
| ZFSC-24-1 | 96 |
| ZFSC-24-6 | 96 |
| ZFSC-24-11 | 96 |
| ZFSC-24-11-75 | 96 |
| ZFSC-48-1 | 96 |
| ZFSC-48-1-75 | 96 |
| ZFSCJ-2-1 | 80 |
| ZFSCJ-2-2 | 80 |
| ZFSCJ-2-3 | 80 |
| ZFSCJ-2-4 | 80 |
| ZMSC-2-1 | 74 |
| ZMSC-2-1W | 74 |
| ZMSC-2-2 | 74 |
| ZMSC-3-1 | 83 |
| ZMSC-3-2 | 83 |
| ZMSC-4-1 | 86 |
| ZMSC-4-2 | 86 |
| ZMSC-4-3 | 86 |
| ZMSCJ-2-1 | 80 |
| ZMSCJ-2-2 | 80 |
| ZMSCQ-2-21.4 | 77 |
| ZMSCQ-2-50 | 77 |
| ZMSCQ-2-90 | 77 |
| ZMSCQ-2-120 | 77 |
| ZMSCQ-2-180 | 77 |
| ZN2PD-920 | 75 |
| ZN2PD-920W | 75 |
| ZN2PD-1900 | 75 |
| ZN2PD-1900W | 75 |
| ZN3PD-900 | 82 |
| ZN3PD-900W | 82 |
| ZN4PD-920 | 87 |
| ZN4PD-920W | 87 |
| ZSC-2-1 | 74 |
| ZSC-2-1-75 | 74 |
| ZSC-2-1W | 74 |
| ZSC-2-2 | 74 |
| ZSC-2-2-75 | 74 |
| ZSC-2375 | 74 |
| ZSC-2-4 | 74 |
| ZSC-3-1 | 83 |
| ZSC-3-1-75 | 83 |
| ZSC-3-2 | 83 |
| ZSC-3-2-75 | 83 |
| ZSC-4-1 | 86 |
| ZSC-4-1-75 | 86 |
| ZSC-4-2 | 86 |
| ZSC-4-3 | 86 |
| ZSC-4-3-75 | 86 |
| ZSCJ-2-1 | 80 |
| ZSCJ-2-2 | 80 |
| ZSCQ-2-50 | 77 |
| ZSCQ-2-90 | 77 |
| ZSCQ-2-180 | 77 |


## high power combiners/ splitters


| model | pages |
|---|---|
| ZA2CS-2G-20W | 70 |
| ZA2CS-500-15W | 70 |
| ZA2CS-600-10W | 70 |
| ZA3CS-400-3W | 70 |
| ZA3CS-450-9W | 70 |
| ZB3CS-920-15W | 70 |
| ZB4CS-440-12W | 70 |
| ZB4CS-960-12W | 70 |
| ZB6CS-150-12W | 71 |
| ZB8CS-950-32W | 71 |


## amplifiers


| model | pages |
|---|---|
| AMP-3G | 113 |
| AMP-11-2 | 110 |
| AMP-15 | 110 |
| AMP-74 | 113 |
| AMP-75 | 110 |
| AMP-76 | 110 |
| AMP-77 | 110 |
| AMP-2000 | 113 |
| ERA-1 | 104 |
| ● ERA-1SM | 104 |
| ERA-2 | 104 |
| ● ERA-2SM | 104 |
| ERA-3 | 104 |
| ● ERA-3SM | 104 |
| ERA-4 | 104 |
| ● ERA-4SM | 104 |
| ERA-5 | 104 |
| ● ERA-5SM | 104 |
| LZY-1 | 117 |
| LZY-2 | 117 |
| MAN-1 | 113 |
| MAN-1AD | 112 |
| MAN-11AD | 112 |
| MAN-1HLN | 110 |
| MAN-1LN | 110 |
| MAN-2 | 113 |
| MAN-2AD | 112 |
| MAR-1 | 108 |
| ● MAR-1SM | 106 |
| MAR-2 | 108 |
| ● MAR-2SM | 106 |
| MAR-3 | 108 |
| ● MAR-3SM | 106 |
| MAR-4 | 108 |
| ● MAR-4SM | 106 |
| MAR-6 | 108 |
| ● MAR-6SM | 106 |
| MAR-7 | 108 |
| ● MAR-7SM | 106 |
| MAR-8 | 108 |
| ● MAR-8SM | 106 |
| MAV-1 | 109 |
| ● MAV-1SM | 106 |
| MAV-2 | 109 |
| ● MAV-2SM | 106 |
| MAV-3 | 109 |
| ● MAV-3SM | 106 |
| MAV-4 | 109 |
| ● MAV-4SM | 106 |
| ● MAV-5SM | 106 |
| MAV-11 | 109 |
| ● MAV-11SM | 106 |
| ● RAM-1 | 107 |
| ● RAM-2 | 107 |
| ● RAM-3 | 107 |
| ● RAM-4 | 107 |
| ● RAM-6 | 107 |
| ● RAM-7 | 107 |
| ● RAM-8 | 107 |
| TO-0812LN | 111 |
| TO-1217LN | 111 |
| TO-1724LN | 111 |
| ● VAM-3 | 107 |
| ● VAM-6 | 107 |
| ● VAM-7 | 107 |
| ● VNA-25 | 107 |
| ZEL-0812LN | 111 |
| ZEL-1217LN | 111 |
| ZEL-1724LN | 111 |
| ZFL-1HAD | 112 |
| ZFL-2AD | 112 |
| ZFL-2HAD | 112 |
| ZFL-11AD | 112 |
| ZFL-500 | 113 |
| ZFL-500HLN | 110 |
| ZFL-500LN | 110 |
| ZFL-750 | 113 |
| ZFL-1000 | 113 |
| ZFL-1000G | 112 |
| ZFL-1000GH | 112 |
| ZFL-1000H | 113 |
| ZFL-1000LN | 110 |
| ZFL-1000VH | 113 |
| ZFL-2000 | 113 |
| ZFL-2500 | 113 |


## instrumentation amplifiers


| model | pages |
|---|---|
| ZFL-2500VH | 113 |
| ZHL-0812HLN | 111 |
| ZHL-1000-3W | 115 |
| ZHL-1042J | 113 |
| ZHL-1217HLN | 111 |
| ZHL-1724HLN | 111 |
| ZHL-1A | 114 |
| ZHL-1HLD | 112 |
| ZHL-1-2W | 115 |
| ZHL-1-50P3 | 114 |
| ZHL-2 | 114 |
| ZHL-2-8 | 114 |
| ZHL-2-12 | 114 |
| ZHL-2-50P3 | 114 |
| ZHL-3A | 114 |
| ZHL-32A | 114 |
| ZHL-42 | 114 |
| ZHL-42W | 114 |
| ZHL-4240 | 114 |
| ZHL-4240W | 114 |
| ZHL-5W-1 | 115 |
| ZHL-6A | 113 |
| ZHL-7-2W | 115 |
| ZHL-900-10W | 115 |
| ZJL-7G | 113 |
| ZJL-6G | 113 |
| ZJL-3G | 113 |
| ZJL-4G | 113 |
| ZJL-4HG | 113 |
| ZRON-8G | 113 |
| ZVE-8G | 114 |
| T1A-900-10 | 116 |
| T1A-1000-4 | 116 |
| T1A-1000-1R8 | 116 |


## pulse amplifiers


| model | pages |
|---|---|
| ZPUL-21 | 118 |
| ZPUL-30P | 118 |


## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

# Model Index

● Dot indicates surface mount models.

## attenuators / electronic


| model | pages |
|---|---|
| GAS-1 | 120 |
| GAS-2 | 120 |
| GAS-3 | 120 |
| ● LRAS-2-75 | 121 |
| PAS-1 | 120 |
| PAS-2 | 120 |
| PAS-3 | 120 |
| PAS-2000 | 120 |
| ● RAS-1 | 121 |
| ● RAS-2-75 | 121 |
| ● SYAS-1 | 121 |
| ● SYAS-2 | 121 |
| ● SYAS-860 | 121 |
| TFAS-1 | 120 |
| ● TFAS-1SM | 121 |
| TFAS-2 | 120 |
| ● TFAS-2SM | 121 |
| TFAS-860 | 120 |
| ● TFAS-860SM | 121 |
| ZAS-1 | 122 |
| ZAS-3 | 122 |
| ZFAS-2000 | 122 |
| ZMAS-1 | 122 |
| ZMAS-3 | 122 |


## digital step attenuator


| model | pages |
|---|---|
| TOAT-R512 | 123 |
| TOAT-124 | 123 |
| TOAT-3610 | 123 |
| TOAT-4816 | 123 |
| TOAT-51020 | 123 |
| ZFAT-R512 | 123 |
| ZFAT-124 | 123 |
| ZFAT-3610 | 123 |
| ZFAT-4816 | 123 |
| ZFAT-51020 | 123 |
| ZSAT-31R5 | 123 |


## attenuators / terminations


| model | pages |
|---|---|
| AT-1 | 98 |
| AT-2 | 98 |
| AT-3 | 98 |
| AT-3-75 | 98 |
| AT-4 | 98 |
| AT-5 | 98 |
| AT-6 | 98 |
| AT-6-75 | 98 |
| AT-7 | 98 |
| AT-8 | 98 |
| AT-9 | 98 |
| AT-10 | 98 |
| AT-10-75 | 98 |
| AT-12 | 98 |
| AT-15 | 98 |
| AT-15-75 | 98 |
| AT-20 | 98 |
| AT-20-75 | 98 |
| AT-25 | 98 |
| AT-30 | 98 |
| AT-40 | 98 |
| BTRM-50 | 97 |
| BTRM-75 | 97 |
| CAT-1 | 100 |
| CAT-2 | 100 |
| CAT-3 | 100 |
| CAT-3-75 | 100 |
| CAT-4 | 100 |
| CAT-5 | 100 |
| CAT-6 | 100 |
| CAT-6-75 | 100 |
| CAT-7 | 100 |
| CAT-8 | 100 |
| CAT-9 | 100 |
| CAT-10 | 100 |
| CAT-10-75 | 100 |
| CAT-12 | 100 |
| CAT-15 | 100 |
| CAT-15-75 | 100 |
| CAT-20 | 100 |
| CAT-20-75 | 100 |
| CAT-25 | 100 |
| CAT-30 | 100 |
| CAT-40 | 100 |
| MAT-1 | 98 |
| MAT-2 | 98 |
| MAT-3 | 98 |
| MAT-4 | 98 |
| MAT-5 | 98 |
| MAT-6 | 98 |
| MAT-7 | 98 |
| MAT-8 | 98 |
| MAT-9 | 98 |
| MAT-10 | 98 |
| MAT-12 | 98 |
| MAT-15 | 98 |
| MAT-20 | 98 |
| MAT-25 | 98 |
| MAT-30 | 98 |
| MAT-40 | 98 |
| NAT-1 | 101 |
| NAT-1-2W | 101 |
| NAT-2 | 101 |
| NAT-2-2W | 101 |
| NAT-3 | 101 |
| NAT-3-2W | 101 |
| NAT-4 | 101 |
| NAT-5 | 101 |
| NAT-6 | 101 |
| NAT-7 | 101 |
| NAT-8 | 101 |
| NAT-9 | 101 |
| NAT-10 | 101 |
| NAT-12 | 101 |
| NAT-15 | 101 |
| NAT-20 | 101 |
| NAT-25 | 101 |
| NAT-30 | 101 |
| NAT-40 | 101 |
| NTRM-50 | 97 |
| ● PAT-1 | 99 |
| ● PAT-2 | 99 |
| ● PAT-3 | 99 |
| ● PAT-4 | 99 |
| ● PAT-5 | 99 |
| ● PAT-6 | 99 |
| ● PAT-7 | 99 |
| ● PAT-8 | 99 |
| ● PAT-9 | 99 |
| ● PAT-10 | 99 |
| ● PAT-12 | 99 |
| ● PAT-15 | 99 |
| ● PAT-20 | 99 |
| ● PAT-30 | 99 |
| SAT-0.5 | 101 |
| SAT-1 | 101 |
| SAT-2 | 101 |
| SAT-2.5 | 101 |
| SAT-3 | 101 |
| SAT-4 | 101 |
| SAT-5 | 101 |
| SAT-6 | 101 |
| SAT-7 | 101 |
| SAT-8 | 101 |
| SAT-9 | 101 |
| SAT-10 | 101 |
| SAT-12 | 101 |
| SAT-15 | 101 |
| SAT-20 | 101 |
| SAT-30 | 101 |
| SAT-40 | 101 |
| STRM-50 | 97 |


## directional couplers


| model | pages |
|---|---|
| ● JDC-6-1 | 124 |
| ● JDC-10-2 | 124 |
| ● JDC20-1W-75 | 124 |
| ● JDC-20-2 | 124 |
| ● LRDC-10-1 | 124 |
| ● LRDC-10-1-75 | 124 |
| ● LRDC-10-2-75 | 124 |
| ● LRDC-10-2W-75 | 124 |
| ● LRDC-12-1-75 | 124 |
| ● LRDC-20-2 | 124 |
| PDC-10-1 | 126 |
| PDC-10-1-75 | 126 |
| PDC-10-1BD | 126 |
| PDC-10-2 | 126 |
| PDC-10-5 | 126 |
| PDC-10-6 | 126 |
| PDC-10-6-75 | 126 |
| PDC-10-21 | 126 |
| PDC-10-22 | 126 |
| PDC-10-54 | 126 |
| PDC-15-6 | 126 |
| PDC-15-6-75 | 126 |
| PDC-15-21 | 126 |
| PDC-20-1 | 126 |
| PDC-20-1BD | 126 |
| PDC-20-1W | 126 |
| PDC-20-3 | 126 |
| PDC-20-3-75 | 126 |
| PDC-20-3BD | 126 |
| PDC-20-6-75 | 126 |
| PDC20-400HP | 125 |
| PDC-20A-5 | 126 |
| PDC20-900HP | 125 |
| PDC20-970HP | 125 |
| P4DC-30A-2 | 126 |
| ● SCDC-11-2 | 124 |
| ● SCDC-25-2 | 124 |
| TDC-6-1 | 126 |
| TDC-10-1 | 126 |
| TDC-10-2 | 126 |
| TODC-10-1 | 126 |
| ZDC-10-1 | 127 |
| ZDC-10-1-75 | 127 |
| ZDC-10-2 | 127 |
| ZDC-15-2 | 127 |
| ZDC-15-6 | 127 |
| ZDC-15-6-75 | 127 |
| ZDC-20-1 | 127 |
| ZDC-20-3 | 127 |
| ZDC-20-3-75 | 127 |
| ZDC-20-3-75-1 | 127 |
| ZDC-2375 | 127 |
| ZEDC-10-2B | 127 |
| ZEDC-15-2B | 127 |
| ZFBDC20-900HP | 125 |
| ZFBDC20-970HP | 125 |
| ZFDC-10-1 | 127 |
| ZFDC-10-1-75 | 127 |
| ZFDC-10-2 | 127 |
| ZFDC-10-21 | 127 |
| ZFDC-10-21-75 | 127 |
| ZFDC-10-22 | 127 |
| ZFDC-10-5 | 127 |
| ZFDC-10-6 | 127 |
| ZFDC-15-5 | 127 |
| ZFDC-15-6 | 127 |
| ZFDC-15-6-75 | 127 |
| ZFDC-20-1H | 125 |
| ZFDC-20-3 | 127 |
| ZFDC-20-3-75 | 127 |
| ZFDC-20-4 | 127 |
| ZFDC-20-4L | 127 |
| ZFDC-20-5 | 127 |
| ZFDC-3375 | 127 |
| ZMDC-10-1 | 127 |
| ZMDC-10-2 | 127 |
| ZMDC-15-6 | 127 |
| ZMDC-20-1 | 127 |
| ZMDC-20-3 | 127 |
| ZMDC-30-1 | 127 |


## filters


| model | pages |
|---|---|
| BBLP-39 | 133 |
| BBLP-117 | 133 |
| BBLP-156 | 133 |
| BBLP-200 | 133 |
| BBLP-300 | 133 |
| BBLP-467 | 133 |
| BBP-10.7 | 132 |
| BBP-21.4 | 132 |
| BBP-30 | 132 |
| BBP-60 | 132 |
| BBP-70 | 132 |
| BHP-25 | 135 |
| BHP-50 | 135 |
| BHP-100 | 135 |
| BHP-150 | 135 |
| BHP-175 | 135 |
| BHP-200 | 135 |
| BHP-250 | 135 |
| BHP-300 | 135 |
| BHP-400 | 135 |
| BHP-500 | 135 |
| BHP-600 | 135 |
| BHP-700 | 135 |
| BHP-800 | 135 |
| BHP-900 | 135 |
| BHP-1000 | 135 |
| BIF-21.4 | 132 |
| BIF-30 | 132 |
| BIF-40 | 132 |
| BIF-50 | 132 |
| BIF-60 | 132 |
| BIF-70 | 132 |
| BLP-1.9 | 130 |
| BLP-2.5 | 130 |
| BLP-5 | 130 |
| BLP-7-75 | 130 |
| BLP-10.7 | 130 |
| BLP-10.7-75 | 130 |
| BLP-15 | 130 |
| BLP-15-75 | 130 |
| BLP-21.4 | 130 |
| BLP-21.4-75 | 130 |
| BLP-30 | 130 |
| BLP-30-75 | 130 |
| BLP-50 | 130 |
| BLP-50-75 | 130 |
| BLP-70 | 130 |
| BLP-90 | 130 |
| BLP-100 | 130 |
| BLP-100-75 | 130 |
| BLP-150 | 130 |
| BLP-200 | 130 |
| BLP-250 | 130 |
| BLP-300 | 130 |
| BLP-450 | 130 |
| BLP-550 | 130 |
| BLP-600 | 130 |
| BLP-600-75 | 130 |
| BLP-750 | 130 |
| BLP-800 | 130 |
| BLP-850 | 130 |
| BLP-850-75 | 130 |
| BLP-1000 | 130 |
| BLP-1200 | 130 |
| NBLP-39 | 133 |
| NBLP-117 | 133 |
| NBLP-156 | 133 |
| NBLP-200 | 133 |
| NBLP-300 | 133 |
| NBLP-467 | 133 |
| NBLP-933 | 133 |
| NBLP-1870 | 133 |
| NBP-10.7 | 132 |
| NBP-21.4 | 132 |
| NBP-30 | 132 |
| NBP-60 | 132 |
| NBP-70 | 132 |
| NHP-25 | 135 |
| NHP-50 | 135 |
| NHP-100 | 135 |
| NHP-150 | 135 |
| NHP-175 | 135 |
| NHP-200 | 135 |
| NHP-250 | 135 |
| NHP-300 | 135 |
| NHP-400 | 135 |
| NHP-500 | 135 |
| NHP-600 | 135 |
| NHP-700 | 135 |
| NHP-800 | 135 |
| NHP-900 | 135 |
| NHP-1000 | 135 |
| NIF-21.4 | 132 |
| NIF-30 | 132 |
| NIF-40 | 132 |
| NIF-50 | 132 |
| NIF-60 | 132 |
| NIF-70 | 132 |
| NLP-1.9 | 131 |
| NLP-2.5 | 131 |
| NLP-5 | 131 |
| NLP-10.7 | 131 |
| NLP-15 | 131 |
| NLP-21.4 | 131 |
| NLP-30 | 131 |
| NLP-50 | 131 |
| NLP-70 | 131 |
| NLP-90 | 131 |
| NLP-100 | 131 |
| NLP-150 | 131 |
| NLP-200 | 131 |
| NLP-250 | 131 |
| NLP-300 | 131 |
| NLP-450 | 131 |
| NLP-550 | 131 |
| NLP-600 | 131 |
| NLP-750 | 131 |
| NLP-800 | 131 |
| NLP-850 | 131 |
| NLP-1000 | 131 |
| NLP-1200 | 131 |
| PBLP-39 | 133 |
| PBLP-117 | 133 |
| PBLP-156 | 133 |
| PBLP-200 | 133 |
| PBLP-300 | 133 |
| PBLP-467 | 133 |
| PBP-10.7 | 132 |
| PBP-21.4 | 132 |
| PBP-30 | 132 |
| PBP-60 | 132 |
| PBP-70 | 132 |
| PHP-25 | 134 |
| PHP-50 | 134 |
| PHP-100 | 134 |
| PHP-150 | 134 |
| PHP-175 | 134 |
| PHP-200 | 134 |
| PHP-250 | 134 |
| PHP-300 | 134 |
| PHP-400 | 134 |
| PHP-500 | 134 |
| PHP-600 | 134 |
| PHP-700 | 134 |
| PHP-800 | 134 |
| PHP-900 | 134 |
| PHP-1000 | 134 |
| PIF-21.4 | 132 |
| PIF-30 | 132 |
| PIF-40 | 132 |
| PIF-50 | 132 |
| PIF-60 | 132 |
| PIF-70 | 132 |
| PLP-1.9 | 128 |
| PLP-2.5 | 128 |
| PLP-5 | 128 |
| PLP-7-75 | 128 |
| PLP-10.7 | 128 |
| PLP-10.7-75 | 128 |
| PLP-15 | 128 |
| PLP-15-75 | 128 |
| PLP-21.4 | 128 |
| PLP-21.4-75 | 128 |
| PLP-30 | 128 |
| PLP-30-75 | 128 |
| PLP-50 | 128 |
| PLP-50-75 | 128 |
| PLP-70 | 128 |
| PLP-90 | 128 |
| PLP-100 | 128 |
| PLP-100-75 | 128 |
| PLP-150 | 128 |
| PLP-200 | 128 |
| PLP-250 | 128 |
| PLP-300 | 128 |
| PLP-450 | 128 |
| PLP-550 | 128 |
| PLP-600 | 128 |
| PLP-600-75 | 128 |
| PLP-750 | 128 |
| PLP-800 | 128 |
| PLP-850 | 128 |
| PLP-850-75 | 128 |
| PLP-1000 | 128 |
| PLP-1200 | 128 |
| SBLP-39 | 133 |
| SBLP-117 | 133 |
| SBLP-156 | 133 |
| SBLP-200 | 133 |
| SBLP-300 | 133 |
| SBLP-467 | 133 |
| SBLP-933 | 133 |
| SBLP-1870 | 133 |
| SBP-10.7 | 132 |
| SBP-21.4 | 132 |
| SBP-30 | 132 |
| SBP-60 | 132 |
| SBP-70 | 132 |
| ● SCHF-25 | 134 |
| ● SCHF-300 | 134 |
| ● SCLF-5 | 129 |
| ● SCLF-8 | 129 |
| ● SCLF-10.7 | 129 |
| ● SCLF-21.4 | 129 |
| ● SCLF-25 | 129 |
| ● SCLF-30 | 129 |
| ● SCLF-45 | 129 |
| ● SCLF-95 | 129 |
| ● SCLF-135 | 129 |
| ● SCLF-190 | 129 |
| ● SCLF-225 | 129 |
| ● SCLF-380 | 129 |
| ● SCLF-420 | 129 |
| ● SCLF-550 | 129 |
| ● SCLF-700 | 129 |
| ● SCLF-1000 | 129 |
| SHP-25 | 135 |
| SHP-50 | 135 |
| SHP-100 | 135 |
| SHP-150 | 135 |
| SHP-175 | 135 |
| SHP-200 | 135 |
| SHP-250 | 135 |
| SHP-300 | 135 |
| SHP-400 | 135 |
| SHP-500 | 135 |
| SHP-600 | 135 |
| SHP-700 | 135 |
| SHP-800 | 135 |
| SHP-900 | 135 |
| SHP-1000 | 135 |
| SIF-21.4 | 132 |
| SIF-30 | 132 |
| SIF-40 | 132 |
| SIF-50 | 132 |
| SIF-60 | 132 |
| SIF-70 | 132 |
| SLP-1.9 | 131 |
| SLP-2.5 | 131 |
| SLP-5 | 131 |
| SLP-10.7 | 131 |
| SLP-15 | 131 |
| SLP-21.4 | 131 |
| SLP-30 | 131 |
| SLP-50 | 131 |
| SLP-70 | 131 |
| SLP-90 | 131 |
| SLP-100 | 131 |
| SLP-150 | 131 |
| SLP-200 | 131 |
| SLP-250 | 131 |
| SLP-300 | 131 |
| SLP-450 | 131 |
| SLP-550 | 131 |
| SLP-600 | 131 |
| SLP-750 | 131 |
| SLP-800 | 131 |
| SLP-850 | 131 |
| SLP-1000 | 131 |
| SLP-1200 | 131 |




Mini-Circuits®
*INTERNET* http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
*Distribution Centers/* NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## frequency doublers

| model | pages |
|---|---|
| AK-2 | 136 |
| AK-3000 | 136 |
| FD-2 | 136 |
| FK-5 | 136 |
| FK-3000 | 136 |
| GK-2 | 137 |
| GK-3 | 137 |
| GK-5 | 137 |
| LK-3000 | 137 |
| MK-2 | 137 |
| MK-3 | 137 |
| MK-5 | 137 |
| RK-2 | 136 |
| RK-3 | 136 |
| RK-5 | 136 |
| RK-6 | 136 |
| RK-3000 | 136 |
| SK-2 | 136 |
| ● SYK-2R | 136 |

## limiters

| model | pages |
|---|---|
| PLS-1 | 169 |
| PLS-2 | 169 |
| PLS-6 | 169 |

## phase shifters

| model | pages |
|---|---|
| ● JSPHS-446 | 139 |
| SPH-16 | 139 |

## bias-tees

| model | pages |
|---|---|
| ● JEBT-4R2G | 152 |
| ● JEBT-4R2GW | 152 |
| ● JEBT-6G | 152 |
| ● JEBT-6GW | 152 |
| PBTC-1G | 153 |
| PBTC-1GW | 153 |
| PBTC-3G | 153 |
| PBTC-3GW | 153 |
| ZFBT-4R2G | 153 |
| ZFBT-4R2G-FT | 153 |
| ZFBT-4R2GW | 153 |
| ZFBT-4R2GW-FT | 153 |
| ZFBT-6G | 153 |
| ZFBT-6G-FT | 153 |
| ZFBT-6GW | 153 |

## impedance pad

| model | pages |
|---|---|
| BMP-5075 | 97 |
| BMP-5075R | 97 |

## modulators/ demodulators

### BPSK, I/Q & QPSK

| model | pages |
|---|---|
| ● JCBM-1000DR | 140 |
| ● JCIQ-88M | 143 |
| ● JCIQ-176M | 143 |
| ● JCIQ-176D | 145 |
| ● JCIQ-895D | 145 |
| ● JCIQ-1785D | 145 |
| ● JCIQ-1880D | 145 |
| MIQA-10D | 144 |
| MIQA-10M | 142 |
| MIQA-21D | 144 |
| MIQA-21M | 142 |
| MIQA-70D | 144 |
| MIQA-70M | 142 |
| MIQA-70ML | 142 |
| MIQA-91M | 142 |
| MIQA-100M | 142 |
| MIQA-108M | 142 |
| MIQA-195M | 142 |
| MIQC-38D | 144 |
| MIQC-38M | 142 |
| MIQC-60WD | 144 |
| MIQC-88M | 142 |
| MIQC-176M | 142 |
| MIQC-895D | 144 |
| MIQC-895M | 142 |
| MIQC-1785M | 142 |
| MIQC-1880M | 142 |
| MIQY-1.25D | 144 |
| MIQY-70D | 144 |
| MIQY-70M | 142 |
| MIQY-140D | 144 |
| MIQY-140M | 142 |
| PMQ-94 | 141 |
| PMQ-330 | 141 |
| PMQ-440 | 141 |
| PMQPW-150 | 141 |
| PMQPW-250 | 141 |
| QMC-100 | 141 |
| QMC-170 | 141 |
| QMC-1050 | 141 |
| ZAMIQ-895D | 144 |
| ZAMIQ-895M | 142 |
| ZFMIQ-10D | 144 |
| ZFMIQ-10M | 142 |
| ZFMIQ-70D | 144 |
| ZFMIQ-70ML | 142 |
| ZFMIQ-91M | 142 |
| ZFMIQ-100M | 142 |
| ZFMIQ-108M | 142 |
| ZMQ-1050 | 141 |

## phase detectors

| model | pages |
|---|---|
| LPD-1 | 138 |
| MPD-1 | 138 |
| MPD-2 | 138 |
| MPD-21 | 138 |
| RPD-1 | 138 |
| RPD-2 | 138 |
| ● SYPD-1 | 138 |
| ● SYPD-2 | 138 |
| ZRPD-1 | 138 |

## switches

| model | pages |
|---|---|
| ● GSWA-4-30DR | 148 |
| ● KSW-2-46 | 150 |
| ● KSWA-2-46 | 150 |
| ● KSWHA-1-20 | 150 |
| ● MSW-2-20 | 151 |
| ● MSWA-2-20 | 151 |
| ● MSWT-4-20 | 151 |
| PSW-1211 | 147 |
| TOSW-230 | 146 |
| TOSW-425 | 146 |
| ● YSW-2-50DR | 148 |
| ● YSWA-2-50DR | 148 |
| ZFSW-2-46 | 149 |
| ZFSWA-2-46 | 149 |
| ZFSWHA-1-20 | 149 |
| ZMSW-1111 | 147 |
| ZMSW-1211 | 147 |
| ZSDR-230 | 146 |
| ZSDR-425 | 146 |
| ZYSW-2-50DR | 149 |
| ZYSWA-2-50DR | 149 |

## oscillators

| model | page |
|---|---|
| ● JCOS-820BLN | 157 |
| ● JCOS-820WLN | 157 |
| ● JCOS-1100LN | 157 |
| ● JTOS-50 | 155 |
| ● JTOS-75 | 155 |
| ● JTOS-100 | 155 |
| ● JTOS-150 | 155 |
| ● JTOS-200 | 155 |
| ● JTOS-300 | 155 |
| ● JTOS-400 | 155 |
| ● JTOS-535 | 155 |
| ● JTOS-765 | 155 |
| ● JTOS-1025 | 155 |
| POS-50 | 154 |
| POS-75 | 154 |
| POS-100 | 154 |
| POS-150 | 154 |
| POS-200 | 154 |
| POS-300 | 154 |
| POS-400 | 154 |
| POS-535 | 154 |
| POS-765 | 154 |
| POS-1025 | 154 |
| POS-1060 | 154 |
| POS-1400 | 154 |
| POS-2000 | 154 |
| ZOS-50 | 156 |
| ZOS-75 | 156 |
| ZOS-100 | 156 |
| ZOS-150 | 156 |
| ZOS-200 | 156 |
| ZOS-300 | 156 |
| ZOS-400 | 156 |
| ZOS-535 | 156 |
| ZOS-765 | 156 |
| ZOS-1025 | 156 |

## transformers

| model | pages |
|---|---|
| FT1.22-1 | 178 |
| FT1.5-1 | 178 |
| FTB1-1 | 178 |
| FTB1-1-75 | 178 |
| FTB1-6 | 178 |
| T1-1 | 177 |
| ● T1-1-KK81 | 174 |
| T1-1H | 177 |
| ● T1-1H-KK81 | 174 |
| T1-1T | 177 |
| ● T1-1T-KK81 | 174 |
| T1-6 | 177 |
| ● T1-6-KK81 | 174 |
| T1-6T | 176 |
| ● T1-6T-KK81 | 174 |
| T1.18-3 | 177 |
| ● T1.18-3-KK81 | 174 |
| T1.5-1 | 177 |
| ● T1.5-1-KK81 | 174 |
| T1.5-6 | 177 |
| ● T1.5-6-KK81 | 174 |
| T2-1 | 178 |
| ● T2-1-KK81 | 175 |
| T2-1-2W | 177 |
| ● T2-1-2W-KK81 | 176 |
| T2-1T | 176 |
| ● T2-1T-KK81 | 174 |
| T2-613-1 | 178 |
| ● T2-613-1-KK81 | 175 |
| T2.5-6 | 177 |
| ● T2.5-6-KK81 | 174 |
| T2.5-6T | 176 |
| ● T2.5-6T-KK81 | 174 |
| T3-1 | 178 |
| ● T3-1-KK81 | 175 |
| T3-1T | 176 |
| ● T3-1T-KK81 | 174 |
| T4-1 | 176 |
| ● T4-1-KK81 | 174 |
| T4-1-2W | 177 |
| ● T4-1-2W-KK81 | 174 |
| T4-1H | 176 |
| ● T4-1H-KK81 | 174 |
| T4-2 | 178 |
| ● T4-2-KK81 | 175 |
| T4-6 | 177 |
| ● T4-6-KK81 | 174 |
| T4-6T | 176 |
| ● T4-6T-KK81 | 174 |
| T5-1T | 176 |
| ● T5-1T-KK81 | 174 |
| T8-1 | 178 |
| ● T8-1-KK81 | 175 |
| T8-1T | 176 |
| ● T8-1T-KK81 | 174 |
| T9-1 | 177 |
| ● T9-1-KK81 | 174 |
| T9-1H | 177 |
| ● T9-1H-KK81 | 174 |
| T13-1T | 176 |
| ● T13-1T-KK81 | 174 |
| T14-1 | 178 |
| ● T14-1-KK81 | 175 |
| T16-1 | 177 |
| ● T16-1-KK81 | 174 |
| T16-1H | 177 |
| ● T16-1H-KK81 | 174 |
| T16-6T | 176 |
| ● T16-6T-KK81 | 174 |
| T36-1 | 177 |
| ● T36-1-KK81 | 174 |
| T-622 | 178 |
| ● T-622-KK81 | 175 |
| T-626 | 178 |
| ● T-626-KK81 | 175 |
| ● TC1-1 | 174 |
| ● TC1-15 | 174 |
| ● TC4-1W | 174 |
| ● TC4-14 | 174 |
| ● TC8-1 | 174 |
| TMO1-02 | 177 |
| TMO1-1 | 177 |
| TMO1-1T | 176 |
| TMO1.5-1 | 177 |
| TMO2-1 | 178 |
| TMO2-1T | 176 |
| TMO2.5-6 | 177 |
| TMO2.5-6T | 176 |
| TMO3-1 | 178 |
| TMO3-1T | 176 |
| TMO4-1 | 176 |
| TMO4-2 | 178 |
| TMO4-6 | 177 |
| TMO5-1T | 176 |
| TMO6-1 | 177 |
| TMO8-1 | 178 |
| TMO9-1 | 177 |
| TMO13-1T | 176 |
| TMO14-1 | 178 |
| TMO16-1 | 177 |
| TO-75 | 177 |
| TT1-6 | 176 |
| ● TT1-6-KK81 | 174 |
| TT1.5-1 | 176 |
| ● TT1.5-1-KK81 | 174 |
| TT2.5-6 | 176 |
| ● TT2.5-6-KK81 | 174 |
| TT4-1 | 176 |
| ● TT4-1-KK81 | 174 |
| TT4-1A | 176 |
| ● TT4-1A-KK81 | 174 |
| TT16-1 | 176 |
| ● TT16-1-KK81 | 174 |
| TT25-1 | 176 |
| ● TT25-1-KK81 | 174 |
| TTMO1-1 | 176 |
| TTMO4-1A | 176 |
| TTMO25-1 | 176 |
| ● TX1-1 | 174 |
| ● TX1-R5 | 174 |
| ● TX1.5-1 | 174 |
| ● TX16-R3T | 174 |
| ● TX16-1 | 174 |

# designers kits

Mini-Circuits offers a wide range of plug-in and surface-mount component kits to aid the engineer during the evaluation, design, and prototype stages, in addition, there are kits offered to provide components for use in the testing laboratory. These kits contain a carefully-selected group of models that will enable the largest versatility of usage by the engineer.

As an example of Mini-Circuit's quest to exceed out customer's expectations, these kits are priced up to 40 percent lower than the cost of individual units and are available from stock.

| TYPE | KIT NO. | QTY. EACH MODEL | MODEL NUMBERS | TOTAL QUANTITY UNITS | PRICE |
|---|---|---|---|---|---|
| FREQUENCY MIXERS | K-SYM* | 1 | SYM-2, -11, -860, -11LH, 11MH, 11H | 6 | 59.95 |
| | K-TUF* | 1 | TUF-1, 1SM, -2, -2SM, -3, -3SM, -5, -5SM, -11A, -11ASM, -860, -860SM | 12 | 79.95 |
| | K1-RMS* | 1 | RMS-1, -1W, -2, -2D, -2U, -5, -11A, -860 | 8 | 59.95 |
| | K1-LRMS* | 1 | LRMS-1, -1W, -2, -2D, -2U, -5, -11A, -860 | 8 | 59.95 |
| | K2-LRMS* | 1 | LRMS-1LH, -2LH, 5LH, -1MH, -2MH, 5MH, -1H, -2UH, -5H | 9 | 89.95 |
| | K-SM* | 2 | SYM-2, RMS-2, LRMS-2, SCM-2, TUF-2SM | 10 | 59.95 |
| | K-860* | 2 | SYM-860, RMS-860, LRMS-860, TUF-860SM | 8 | 82.60 |
| POWER SPLITTERS | K1-PS* | 1 | SCP-2-1A, SCP-3-1, SCPQ-21.4, SCPQ-90, SCPQ-180, | | |
| | | | SCPQ-400 | 6 | 59.95 |
| | K2-PS | 1 | PSCQ-2-21.4, -2-50, -2-90, -2-180, -2-250, -2-400 | 6 | 99.95 |
| | K3-PS | 2 | PSC-2-1-75, -3-1-75, -4-1-75 | 6 | 99.95 |
| | K4-PS | 2 | PSC-2-1, PSCJ-2-1, AND 1 EACH PSC-3-1A, PSC-4-3 | 6 | 99.95 |
| AMPLIFIERS | DAK-2 | 5 | MAR-1, -2, -3, -4, -6, -7, -8 | 35 | 59.95 |
| | DAK-2SM* | 5 | MAR-1SM, -2SM, -3SM -4SM, -6SM, -7SM, -8SM | 35 | 61.95 |
| | DAK-3* | 3 | MAR-1, -1SM, -2 -2SM, -3, -3SM, -4, -4SM MAR-6, -6SM, -7, -7SM, -8, -8SM, MAR-11, -11SM | 48 | 59.95 |
| | K1-MAN | 1 | MAN-1LN, 1HLN, -1, -2 | 4 | 59.95 |
| | K2-MAN | 1 | MAN-1AD, 11AD, 2AD | 3 | 59.95 |
| | K-ZFL | 1 | ZHL-6A, ZFL-1000, ZFL-2000 | 3 | 395.00 |
| | KZHL-318 | 1 | ZHL-6A, ZHL-1042J, ZRON-8G | 3 | 1095.00 |
| CHIP CAPACITORS | KCAP-1 | 50 | 10PF, 22PF, 47PF, 68PF, 100PF, 220PF, 470PF, 680PF, 1000PF, 2200PF, 4700PF, 6800PF, .010UF, .022UF, .047UF, .068UF, .100UF | 850 | 99.95 |
| DIGITAL STEP ATTENUATORS | K-TOAT | 1 | TOAT-124, -3610, -51020 | 3 | 149.95 |
| | K-ZFAT | 1 | ZFAT-R512, -124, -3610, -51020 | 4 | 299.95 |
| ELECTRONIC ATTENUATORS | K-PAS | 1 | PAS-1, -3, -2000 | 3 | 99.95 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

| TYPE | KIT NO. | QTY. EACH MODEL | MODEL NUMBERS | TOTAL QUANTITY UNITS | PRICE |
|---|---|---|---|---|---|
| FIXED ATTENUATORS/ TERMINATIONS | K1-AT | 4 | AT-3, -6, -10, -20 | 16 | 49.95 |
| | K2-AT | 1 | AT-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, AT-12, -15, -20, -30, -40, -3-75, -6-75, AT-10-75, -15-75, -20-75 | 20 | 49.95 |
| | K1-MAT | 2 | MAT-3, 6, 9, 10, 12, 15, 20, 40 | 16 | 49.95 |
| | K2-MAT | 1 | MAT-1, -2, -3, -4, -5, -6, -7, -8, -9 MAT-10, -12, -15, -20, -25, -30, -40 | 16 | 49.95 |
| | K1-CAT | 2 | CAT-3, -6, -10, -20 | 8 | 89.95 |
| | K2-CAT | 1 | CAT-1, -2, -3, -4, -5, -6, -7, -8, -9, CAT-10, -12, -15, -20, -30, -40 | 15 | 199.95 |
| | K-CAT-75 | 1 | CAT-3-75, -6-75, -10-75, -15-75, -20-75 | 5 | 74.95 |
| | K1-SAT | 2 | SAT-3, -6, -10, -20 | 8 | 109.95 |
| | K2-SAT | 1 | SAT-1, -2, -3, -4, -5, -6, -7, -8, -9, -9, SAT-10, -12, -15, -20, -30, -40 | 15 | 219.95 |
| | K-NAT | 2 | NAT-3, -6, -10, -20 | 8 | 149.95 |
| | K-TRM | 2 | BTRM-50, STRM-50, NTRM-50 | 6 | 49.95 |
| DIRECTIONAL COUPLERS | K1-DC | 1 | ZFDC-10-5, -15-5, -20-5 (BNC CONNECTORS) | 3 | 199.95 |
| | K2-DC | 1 | ZFDC-10-1, -20-4 | 2 | 89.95 |
| | K3-DC | 1 | PDC-10-6, -15-21, -20A-5 | 3 | 79.95 |
| | K4-DC | 1 | PDC-10-1-75, -15-6-75, 20-3-75, 20-6-75 | 4 | 59.95 |
| | K5-DC | 1 | PDC-10-1, -10-54, -10-6 | 3 | 53.95 |
| | K6-DC | 1 | ZFDC-10-21-75, -20-3-75, -3375 (BNC CONNECTORS) | 3 | 119.95 |
| | K7-DC | 1 | ZEDC-10-2B, -15-2B, ZFDC-20-4 (SMA CONNECTORS) | 3 | 149.95 |
| FILTERS | K-SCF* | 1 | SCLF-21.4, -30, -45, -135, -190, -380, -420 | 7 | 59.95 |
| | K-PHP | 1 | PHP-50, -100, -150, -175, -200, -250, -300, PHP-400, -500, -600, -700, -800, -900, -1000 | 14 | 149.95 |
| | K-LHP | 1 | SLP-50, -100, -300, -550, -1000, SHP-200, -400, -700 | 8 | 249.00 |
| | K-PLP | 1 | PLP-5, -10.7, -21.4, -30, -50, -70, -90, PLP-100, -150, -200, -250, -300, -450, -550, PLP-600, -750, -800, -850, -1000, -1200 | 20 | 159.95 |
| PHASE DETECTORS | K-PD* | 1 | MPD-1, MPD-2, MPD-21, SYPD-1, SYPD-2 | 5 | 79.95 |
| SWITCHES | K1-KSW* | 1 | KSW-2-46, KSWA-2-46, KSWHA-1-20 | 3 | 99.95 |
| | K-YSW* | 2 | YSW-2-50DR, YSWA-2-50DR | 4 | 59.95 |
| | K2-KSW* | 1 | KSW-2-46, KSWA-2-46, KSWHA-1-20, YSW-2-50DR, YSWA-2-50DR | 5 | 124.95 |
| | K-ZFSW | 1 | ZFSW-2-46, ZFSWA-2-46 | 2 | 139.95 |
| RF TRANSFORMERS | TTK-1 | 2 | TT1-6, 1.5-1, 2.5-6, 4-1, 4-1A, 16-1, 25-1 | 14 | 79.95 |
| | TK-5 | 2 | T1-1T, T1-6T, T2-1T, T2.5-6T, T3-1T, T4-1T, T4-6T, T5--1T, T8-1T, T13-1T, T16-6T | 22 | 79.95 |
| | TK-6 | 2 | T1-1, 1.18-3, 1-6, 1.5-1, 1.5-6, 2.5-6, 4-6, 9-1, 16-1, 36-1 | 20 | 79.95 |
| | THK-1 | 3 | T1-1H, T4-1H AND 2 EACH T9-1H, T16-1H | 10 | 59.95 |
| | TMK-2 | 2 | TMO-1-1, -2-1, -4-1, -9-1, -16-1 | 10 | 59.95 |

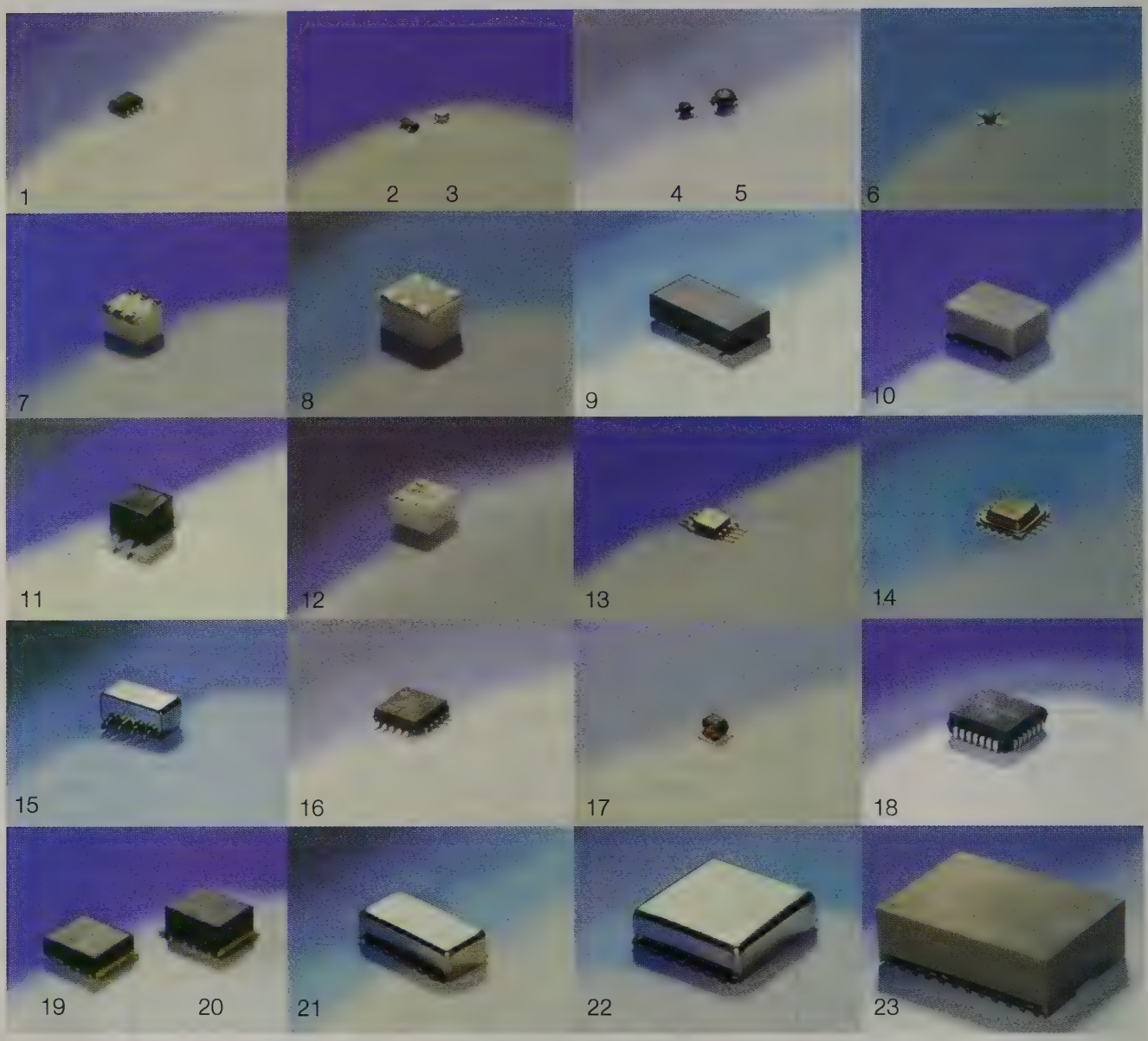
NOTES: *KITS CONTAINING SURFACE-MOUNT UNITS.
(1) AVAILABLE FROM MINI-CIRCUITS DISTRIBUTOR CENTERS.
(2) SORRY, NO SUBSTITUTIONS ALLOWED
(3) PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

Mini-Circuits®

# surface mount devices actual size




| Case Style | | Series Name |
|---|---|---|
| 1 | XX211 | VNA, MSWT, MSW, MSWA |
| 2 | MMM168 | VAM |
| 3 | AF190 | RAM |
| 4 | WW107 | MAR-SM, ERA-SM |
| 5 | RRR137 | MAV-SM |
| 6 | AF320 | PAT |
| 7 | BH292 | JMS, JPS, JDC |
| 8 | TT100 | RMS, RPQ, RAS, TX |
| 9 | YY101 | SCM, SCPQ, SCP |
| | YY161 | SCPJ, SCPQ, SCDC, SCLF |
| 10 | BJ293 | JYM, JYPS |
| 11 | KK81 | ASK, T, TT |
| 12 | QQQ130 | LRMS, LRPQ, LRPS, LRAS, LRDC |
| 13 | XX112 | KSW, KSWA, KSWHA |

| Case Style | | Series Name |
|---|---|---|
| 14 | AG191 | VSW, VSWA |
| 15 | NNN150 | TUF-SM |
| 16 | KKK155 | YSW, YSWA |
| 17 | AT224 | TC |
| 18 | AN213 | GSWA |
| 19 | TTT166 | SYM, SYAS |
| | TTT167 | SYM, SYPD, SYAS, SYPS |
| 20 | AH202 | SYPQ |
| 21 | BK276 | JSIQ, JSPQW, JSPHS |
| | BK343 | JSPQ |
| | BK377 | JTOS |
| 22 | BG291 | JCIQ, JCPS |
| | BG419 | JCOS |
| 23 | BL301 | JEBT |

ALL CATALOG ITEMS GUARANTEED TO BE *SHIPPED WORLDWIDE WITHIN 1 WEEK!*

FOR CUSTOM PRODUCTS AT CATALOG PRICES CONTACT OUR APPLICATIONS DEPT.

*AVAILABLE ON TAPE & REEL*

## surface mount environmental specifications

All MCL products are manufactured under exacting quality assurance and control standards. As a minimum they will meet published specifications after being subjected to any or all of the following physical and environmental tests of MIL-STD-202, unless otherwise noted.

| Rating or Test | MIL-STD-202 | | Package Type | |
|---|---|---|---|---|
| | Method | Condition | Hermetic | Nonhermetic |
| Temperature Operating, °C [1] | — | — | -55 to 100 | -20 to 85 |
| Temperature Storage, °C [1] | — | — | -55 to 100 | -55 to 100 |
| Altitude: 150,000 feet | 105 | E | Yes | — |
| Humidity: 90% RH, 65°C | 106 | — | Yes [2] | — |
| Thermal Shock | 107 | B | -65 to 125°C | -55 to 100 |
| Fine & Gross Leak | 112 | C&D | $1x10^{-7}$ | Not Appl. |
| Solderability: 95% coverage | 208 | — | Yes | Yes |
| Solder heat [3] | — | — | Yes | Yes |
| Solvent resistance | 215 | — | Yes | Yes |

Notes:
1. Extended temperature ranges are available for some models; consult factory. Operating Temperature for RAM models, -55°C to 125°C and VNA, -40°C to 70°C, or as noted on spec. page.
2. Humidity not guaranteed for VSW, VSWA models.
3. Peak temperature during reflow soldering 230°C, see typical profiles page 22, Technical Section.

# understanding surface mount

The main reason for the utilization of surface mount technology today is PWB area efficiency and the corresponding reduction of the system volume. Small surface mount components are used to manufacture electronic assemblies that are significantly smaller than the similar function assemblies using thru-hole components. Usually, the board area for most systems can be reduced by a factor of two for a single sided board. When components are mounted on both sides of the board, size reduction by another factor of two can be achieved. Conversely, the functional density can be doubled in the same area with the use of surface mount components. Since the height of surface mount components are generally smaller, significant reduction in system volume can also be achieved. Fewer, denser assemblies and correspondingly fewer connectors, less mechanical hardware and shorter lead lengths can yield another reduction factor of 2 to 4. Add to that the use of Application Specific IC's (ASIC's), and a total volume amounting to approximately 20 percent of the original system can result.

Size reduction however, is not the only SMT benefit. As a secondary benefit, the ever increasing demand for higher speed circuitry causes time delay reductions of even nanoseconds to be beneficial. Typically, an SMT package will have significantly lower values of inductance, capacitance and resistance compared to dual in-line packages (DIP). This is shown in the table below.Surface mount assembly essentially is a four step manufacturing process:

1 Print the solder paste
2 Place components
3 Reflow the paste to form the solder interconnection between the component and the land area on the PWB
4 Clean-up

The use of a pick-and-place machine can perform the equivalent function handled by 3 to 4 machines in a standard thru-hole assembly area. Additionally, an automated SMT manufacturing line conserves space, uses fewer people, has a shorter cycle time and reduces work in progress inventory. This helps achieve higher yields through more rapid feedback and use of statistical process control data. In all, the savings from automated SMT manufacturing can be as great as 50% compared to a thru-hole manufacturing area designed to build a similar electronic function.

## SURFACE MOUNT VS. DUAL IN-LINE PACKAGES INDUCTANCE AND CAPACITANCE VALUE COMPARISONS

| | DUAL IN-LINE PKG. (DIP) | | SMALL OUTLINE (SO) | | PLASTIC LEADED CHIP CARRIER (PLCC) | |
|---|---|---|---|---|---|---|
| LEADS | L (nH) | C (pF) | L (nH) | C (pF) | L (nH) | C (pF) |
| 8 | 3.2-9.3 | 0.35-1.0 | 2.3-3.8 | 0.22-0.48 | - | - |
| 14 | 3.2-10.2 | 0.38-1.1 | 2.6-3.8 | 0.22-0.54 | - | - |
| 16 | 3.3-10.5 | 0.44-1.1 | 2.4-4.3 | 0.22-0.50 | - | - |
| 20 | 3.4-13.7 | 0.53-1.5 | 4.9-8.5 | 0.45-0.85 | 4.2-5.0 | 0.60-0.65 |
| 24 | 3.8-18.1 | 0.53-1.6 | 4.9-9.5 | 0.43-1.86 | | |
| 28 | 3.8-14.4 | 0.58-1.7 | | | 5.3-6.9 | 0.70-0.75 |
| 40/44 | 3.8-15.3 | 0.60-1.9 | | | 5.2-6.6 | 0.75-0.80 |
| 64/68 | 7.1-28.1 | 0.63-2.4 | | | 5.1-6.4 | 0.78-0.83 |

*Values given are Min. and Max.*

# most often asked questions about surface mount

**Q.** *What is the recommended temperature profile to be used for Mini-Circuits surface mount units?*

**A.** Use as low a temperature as will melt your solder paste and form properly wetting fillets. The solder-melt temperature should be maintained at the surface mount units for the minimum practical time to minimize thermal shock however, preheat at 2°C/second maximum rate and allow at least 2 minutes cool-down time.

**Q.** *What are some of the defects related to the soldering process that can occur and what is the possible causes?*

**A.** At a glance...here are some of the cause and effect relationships for common defects that can occur.

| DEFECTS / Possible Causes | Co-Planarity | Solderability | Metallurgy | Solder-Quality | Solder-Volume | Reflow Profile | Placement Accuracy | Land Design |
|---|---|---|---|---|---|---|---|---|
| Open Joints | X | X | | | X | | X | |
| Tombstoning | | | X | X | X | X | | X |
| Voids | | X | X | X | | X | | |
| Solder Wicking | X | | X | | | X | | |
| Non-Wetting | | X | X | X | | | | |
| Incomplete Fillets | X | | | | X | | X | X |
| Poor Strength | | X | X | X | X | X | | |
| Solder Shorts | | | | | X | | X | X |
| Solder Balls | | X | | X | X | X | | |
| Intermetallics | | | X | X | | X | | |
| Appearance | | | X | | | X | X | |
| Component Cracking | | | X | | X | X | X | X |

**Q.** *Will Mini-Circuits units be capable of meeting performance specs after being subjected to my reflow process?*

**A.** Yes. As a guide, units built with a ceramic or epoxy-glass PC board base will withstand a reflow temperature profile which peaks for 6 seconds at 225°C, spends 90 seconds maximum above 200°C, 2.5 minutes above 175°C and 5 minutes above 150°C. This includes such units as RMS, JMS and SYM, for example. Unencapsulated models such as TC transformers will take more. They can be reflowed with 230°C peak, 5 minutes above 175°C and 7 minutes above 150°C.
Plastic molded amplifiers in the MAR-SM, MAV-SM and VAM series can be reflowed with 230°C peak, 8 seconds above 220°C, 25 seconds above 200°C and 20 minutes above 150°C. The corresponding maximum times for the ceramic-metal RAM amplifiers are several times longer, as shown on the specification pages.
Plastic GaAs switches with drivers such as YSW can withstand 240°C peak and 200°C for 4 minutes. The ceramic-metal VSW version will take 275°C peak.

**Q.** *How are Mini-Circuits mixers designed to resist internal solder melting during reflow process ?*

**A.** Mini-Circuits Ultra-Rel mixers are built tough! All internal connections are welded. Therefore, no solder joints can reflow because there are none.

**Q.** *With regard to cleaning methods which are being used in accordance with new environmental laws, will Mini-Circuits components stand-up after being subjected to aqueous wash?*

**A.** External surfaces will not be adversely affected. Many surface mount components are hermetically sealed or moisture proofed, and are not subject to any restrictions on cleaning fluids generally used on customers' assemblies. Moldid plastic units and some units which have polymeric seals may allow seepage, however. After a water rinse, bake-out of such units is usually necessary to remove moisture and ensure restoration of full electrical performance.
Use of defluxing agents which have non-volatile constituents is not recommended for units subject to seepage, because rinsing will not extract them effectively. Mini-Circuits offers low-cost open assembly and wash-through designs for applications using those defluxing agents.

**Q.** *What is the coplanarity of the leads on Mini-Circuits components?*

**A.** Mini-Circuits surface mount components meet the applicable coplanarity deviation limit in Appendix C of MIL- M- 38510, which is .004 inch (0.102 mm). This includes the KK81 case style. Some of the other gull-wing case styles may have slightly greater deviation. In any event, customers' stated requirements should be achievable.

**Q.** *What effect does the land size have on the strength of the solder joints?*

**A.** The strength of the solder joint is a function of the volume of solder paste, the area of land and the type of component lead. Smaller than optimum land sizes reduce the solder joint strength. Larger sizes provide more tolerance for the screen printer and the pick-and-place machine, but result in little additional joint strength.

**Q.** *What is the recommended spacing between lands?*

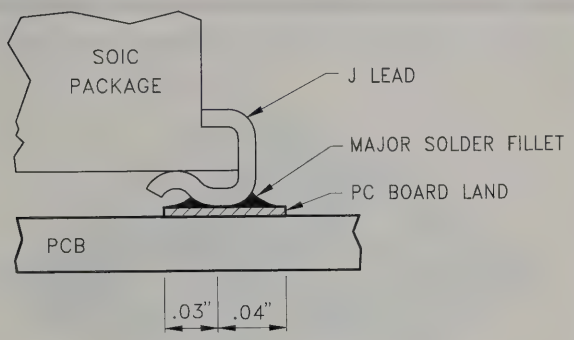
**A.** Maintaining 25 mil spacing between lands helps to minimize shorting due to solder bridging.

**Q.** *What are the advantages of JMS models compared with the RMS mixer?*

**A.** The leads raise the base of the unit above the user's printed wiring board. This higher profile facilitates removal of solder flux after mounting and allows visual inspection of solder connection. The shape of the J lead also allows the device to occupy the minimum area on the board and provides strain relief due to thermal stress. Additionally, the leads allow for easier removal from the printed wiring board for repair or replacement.

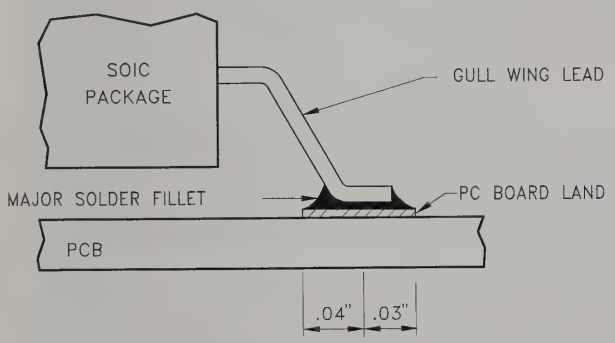
**Q.** *When using J leads, what is the position of the lands with respect to the package so the major fillet formation is optimized?*

**A.** The major fillet of the solder joint for the J lead is on the outside (the "heel") lead; therefore the contact point on the land should be slightly to the inside of the center of the land. A 0.07 inch land size is shown for illustration purposes.




**Q.** *...and what should the position of the land be for gull-wing leads?*

**A.** The heel of the gull-wing lead is on the inside, next to the package body. The major fillet is at the heel. Therefore, the land should be placed so that the greater portion of the land extends under the lead toward the body of the package.




**Q.** *Why is there more than one grounding lead on some Mini-Circuits surface mount components?*

**A.** Many components perform over wide frequency bands with high isolation between specific signal ports and low VSWR. To achieve this performance, reactances of ground-return paths of the units have to be controlled. Therefore, all ground leads should find a short electrical path to the ground plane, preferably via plated-through holes in the PC board. The holes should be located under or near the unit.

**Q.** *How much latitude does one have in bending the leads on a surface mount component?*

**A.** Leads can be bent at angles up to 90 degrees. Hold each lead near the body of the unit while bending, so as not to cause stress where it exits the body. Avoid repeated bends which might fatigue the material.

**Q.** *When soldered to PC board, are crimp leads mechanically strong enough to hold the unit down,or is additional anchoring needed?*

**A.** All Mini-Circuits surface mount components are designed so that normal soldering procedures are sufficient to hold them without additional anchoring.

**Q.** *Does Mini-Circuits 4.5σ repeatability apply to surface mount units?*

**A.** The 4.5σ repeatability specification applies to the same performance characteristics as for functionally equivalent Mini-Circuits models in other packages.

**Q.** *My application dictates a rugged surface mount mixer, but price is critical. What would you recommend?*

**A.** Consider Mini-Circuits TUF series. With all-welded internal and external construction, TUF models are the most rugged surface mount mixers in the world. These 0.5x0.2x0.25 inch metal cased units employ only four gull wings to simplify lead placement on PC boards. TUF mixers are priced low... from $3.95 each (qty. 10).

## glossary of terms

*COPLANARITY*: The relationship between the leads of a component and the lands on a printed wiring board.

*INTERMETALLICS*: (Intermetallic Compound-IMC) Metallic compounds that form at the surfaces between different metals. IMC's typically have significantly different properties than the original metals, such as tensile strength.

*LAND*: The metal conductor surface on the substrate or PWB on to which the component lead is attached with solder.

*METALLURGY*: The art of working metals.

*NON-WETTING*: The characteristic of a metal surface where the solder comes in contact but does not form an intermetallic or metallurgical bond.

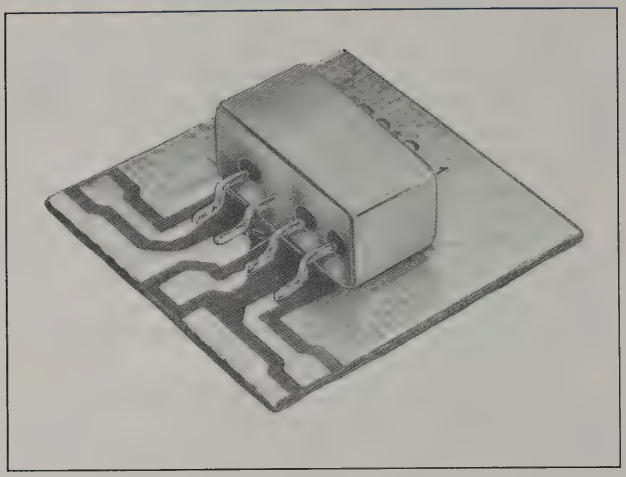
*PRINTED WIRING BOARD*: (PWB) Also called printed circuit board (PCB). The substrate, generally epoxy glass, used to provide component attachment lands and interconnections to form a functioning electronic circuit.

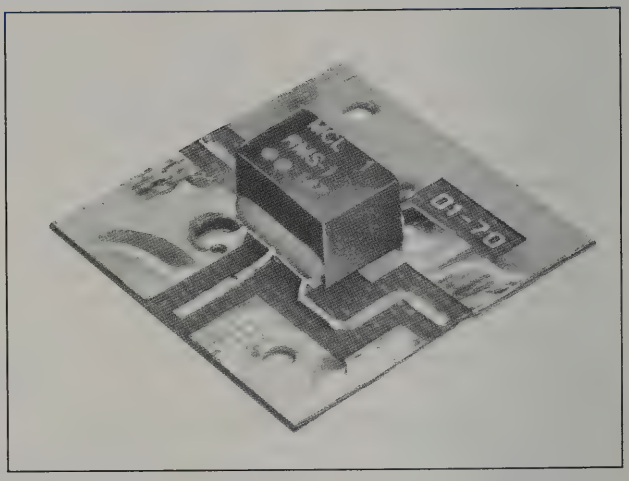
*TOMBSTONING*: Refers to a chip capacitor or resistor that is standing on one solder termination (also "drawbridging").

*VOIDS*: A cavity inside the solder, generally formed by gases trapped during cool down of the soldering step.

*WICKING*: The action that causes the solder to move from one area to another by wetting the surface of solderable metal.

# practical considerations for attaching surface-mount components





The photos included illustrate some of these components soldered to circuit boards.

What automated soldering methods can be considered for Mini-Circuits surface-mount components? There are two basic methods: reflow and wave soldering. Generally, reflow soldering can be done when (1) there are only surface-mount components, or (2) these are present together with through-hole components and the latter will be soldered in a separate (wave-soldering) step. The surface-mount components can be located on both the upper and lower sides of the board, when reflow is used. Wave soldering is suitable for through-hole components mounted on top of the board as well as for surface-mount components on the bottom of the board. Both ceramic and polymer-based boards can be accommodated.

## reflow

Reflow requires applying a controlled amount of solder and flux to the areas where connections are to be made. A common technique is to print a pattern of solder paste on the board, and then put the components onto their places. They tend to stay in position because of the stickiness of the paste. Optionally, components can be held with chip-bonding epoxy. When heat is applied, it must produce a time-temperature profile suitable for accomplishing several process steps as illustrated in Figure 1.

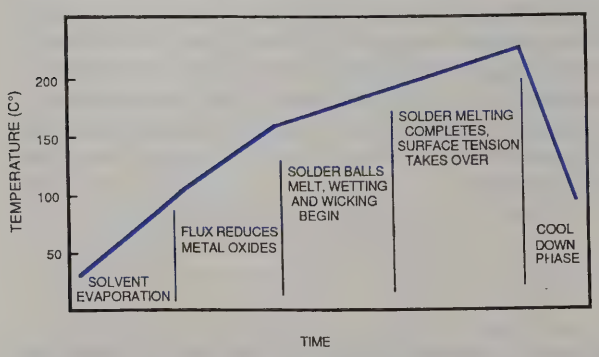



**Fig. 1 Solder Reflow Phases**

First, solvent evaporation is done at temperatures up to about 100°C. Second, flux reduces metal oxides as temperature rises to the solder melting point, typically 183°C. Third, as temperature continues to rise, the solder particles in the paste melt and wetting and wicking in the joint area begin. In the next step when temperature reaches a peak around 215°, surface tension shapes the fillet of fully molten solder. It takes only a few seconds for proper solder wetting at that temperature. The length of time that the work is actually above 200° is usually limited to one or two minutes to avoid damage. Many plastic-encapsulated components can withstand several minutes of solder-melt temperature when reflowed. Even at the higher temperature experienced in wave soldering (see below), such components tend to withstand several seconds immersion in molten solder.

There are several techniques for applying the heat needed for reflow. Two of the most common are infrared and vapor-phase. Infrared heat sources operate at very high temperature and are placed at the inner walls of the chamber, not in contact with the work. The actual temperature of the work is strongly affected by its mass, geometry and composition, as well as belt speed. Organic materials such as epoxy-based boards tend to absorb the IR radiation and conduct the heat to metal parts which, by themselves, would tend to reflect the IR away. On the other hand, in the vapor-phase soldering process the vapor surrounding the work is maintained at the optimum solder-wetting temperature. This is accomplished by boiling an inert liquid in a tank. The boiling point is approximately 215°C. When the work is held in the vapor just above the liquid, the heat at that temperature is transferred to all surfaces quite uniformly.

Figures 2 and 3 illustrate profiles obtained with both reflow processes. Separately controlled heating zones in an IR oven provide an opportunity to shape the profile more optimally than is typical of the vapor phase process. However, the infrared method may require more careful setup to avoid undesired nonumiformity of heating.

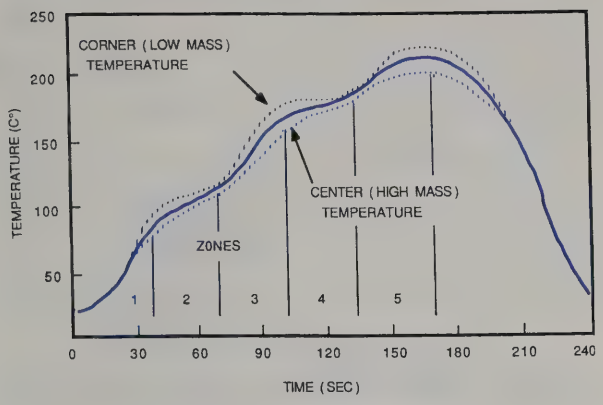



**Fig. 2 Typical Five-Zone Infrared Profile.**

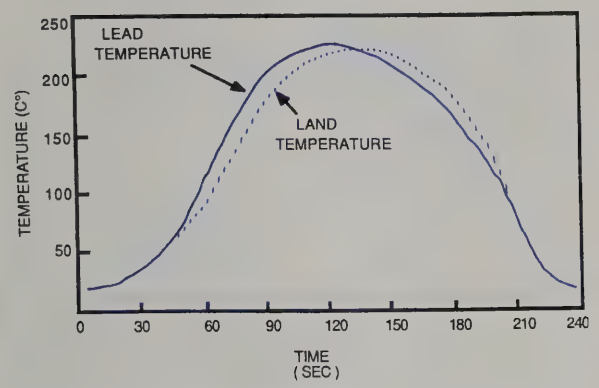



**Fig. 3 Typical Vapor Phase Profile**

## wave soldering

This method applied molten solder to the bottom side of a circuit board after a preheating sequence, with cool-down following the soldering. There are variations to the method, mainly characterized by the shape of the solder wave; the choice among them is influenced by the type of assembly and the components being mounted. Solder temperature, typically 260°C , is higher then the peak temperatures used in the reflow method. The temperature profile experienced by the board and components increases during preheat to about 150° at a rate similar to reflow, but then rises rapidly when the solder wave impinges.

Components housed in molded plastic cases may be better suited to reflow soldering because of the possibility of microcracks developing at the leads if they are wave soldered. Resistance to this defect is enhanced when moisture is baked out of the plastic material before soldering by either method; 24 hours at 125°C is usually effective.

## some pointers

Among the considerations for successful attachment of surface-mount components are:

- Lead coplanarity,and wettability by the solder.
- Compatibility of solder composition with finish on components and circuit boards.
- Amount of solder deposited.
- Internal heating of components.
- Component placement and orientation accuracy.

Leads on a component should all be in the same plane. More departure from coplanarity can be tolerated in the reflow method than in wave soldering because in reflow the surface tension in the molten solder tends to bridge small gaps and ensure an acceptable fillet. In wave soldering, special techniques are used to counteract the tendency of surface tension to deposit excess solder and cause undesired bridging between metallization areas. Even so, better coplanarity may be required when wave soldering to ensure good joints.

Wetting, or the ability of solder to adhere to the entire joint surfaces uniformly, is enhanced when clean surfaces on the component leads and circuit board are provided. If the quality of initially suitable surface finishes is preserved by proper handling and storage, the flux applied in the soldering operation should suffice to remove any metallic oxides. Compatibility of the solder includes closeness of its melting point with that of the metallization finishes, and the minimization of materials such as gold which promote the formation of brittle intermetallic compounds with tin-lead solder. The amount of solder to be deposited depends upon joint geometry, but once determined the deposition can be controlled to a few thousandths of an inch by using preforms or printing the solder pattern.

Concern about internal heating of components during soldering becomes greater when the size or complexity of individual components increases, or where assembly contains a mix of large and small components. In the latter case the heating rates can be disparate, or a large component may mask a small one from the source of heat. Careful study and experimentation may be needed to optimize the process. Measurement of air temperature in the processing chamber, even at several points, may not be sufficient with infrared heating. Monitoring with a surface temperature profiler can ensure that small components are not being overheated.

While high accuracy is needed for component placement on a circuit board, this requirement is eased somewhat in the case of reflow because surface tension in the molten solder has a self-centering action. This assumes that a proper metallized footprint has been provided.Correct orientation of components requires assurance that when they are supplied in tape-and-reel, all have been inserted into the tape in a constant and known orientation. Also, the tape

cavity dimensions must ensure that the orientation is maintained. Especially when component placement is done manually, a clear orientation index is necessary on each component. The following considerations tend to keep the components, once placed, from becoming dislodged before the solder solidifies: When all surface-mount components are on top of the board, the stickiness of solder paste and then the surface tension of molten solder usually suffice. Components on the bottom of the board may need pre-attachment with an adhesive such as epoxy. Caution is then necessary to prevent low -viscosity constituents of the adhesive from spreading onto the metallization areas ("creep"), which could inhibit solder wetting.

## automated soldering of Mini-Circuits surface-mount components

Of course, the surface-mount models listed at the beginning of the article can also be mounted by hand-soldering techniques. But, pertinent to the advantage afforded by automated assembly is that most can be soldered in their standard configurations, or require simple modification to their internal connection method or omission of a plastic enclosure, depending upon the particular temperature profile specified for a customer's application.

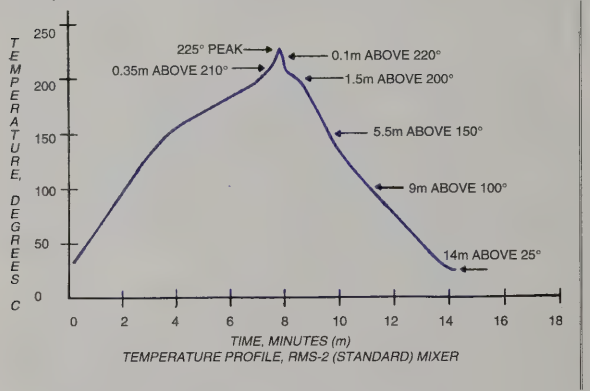



**Fig. 4 Temperature Profile, RMS-2 Mixer**

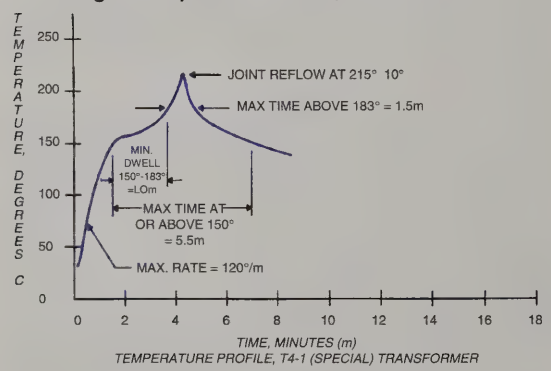



**Fig. 5 Temperature Profile, T4-1 Transformer**

## examples of soldering temperature profiles for Mini-Circuits Components

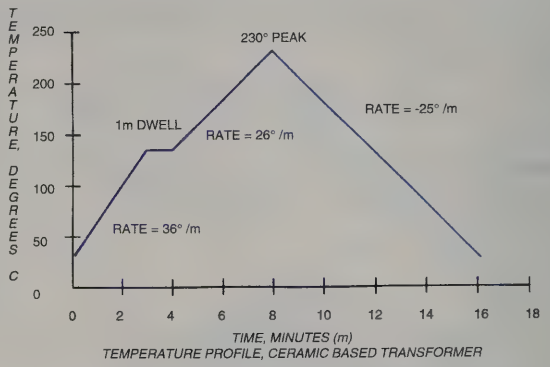



**Fig. 6 Temperature Profile, Ceramic-Base Transformer**

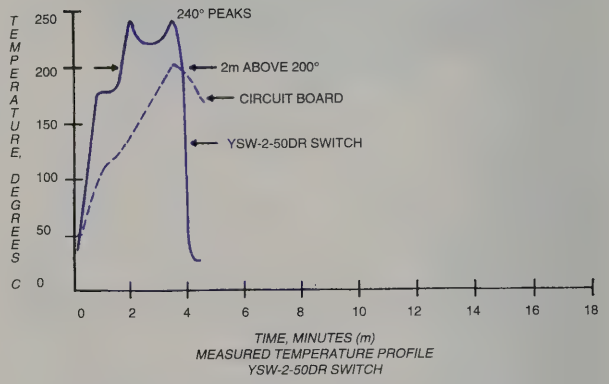



**Fig. 7 Temperature Profile, YSW-2-50DR Switch**

Mixer model RMS-2 meets the temperature profile shown in Figure 4 in its standard configuration. Transformer model T4-1 meets the profile in Figure 5 when a solder having 260°C solidus is used for its internal connections. A special transformer model designated TC, having a smaller version of case style TT100, has a ceramic base and no lid. It accepts the temperature profile shown in Figure 6. All three of these profiles were set by customer's specifications. As a final example, GaAs switches with drivers, in plastic case style KKK155 are designed to withstand a reflow heating and cooling cycle lasting 4 minutes, in which the component itself exceeds 200°C for 2 minutes. Figure 7 shows actual temperatures measured on a switch and on the circuit board to which it is being mounted, using an infrared reflow machine having four zones and seven source panels in a 72-inch overall length. The same GaAs switches in metal-ceramic case style AG191 will withstand a peak case temperature up to 275°C.

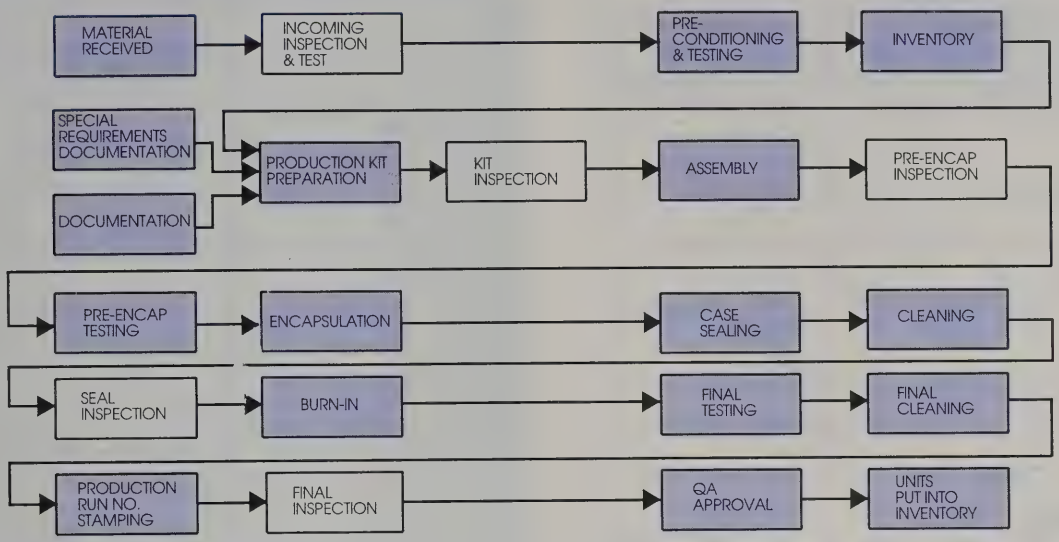


Mini-Circuits®
P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# Mini-Circuits Guarantees Quality

Although we have gone beyond our past objective of exceeding 0.1% AQL- no rejects, not even one per 1000 units-this is not satisfactory anymore. Our present commitments are to achieve a Cpk of 1.5, or 4.5 sigma: not even 4 rejects per million units. Mini-Circuits' process controls using SPC, pre-control and design of experiments reduce variability of performance. "Skinny Sigma" is our way of life and it can be yours. Specify Mini-Circuits RF signal processing components to reduce your inspection costs and improve your production yields.

## *How Mini-Circuits achieves high reliability*




## *Environmental Specifications*

All MCL products are manufactured under exacting quality assurance and control standards. As a minimum they will meet published specifications after being subjected to any or all of the following physical and environmental tests of MIL-STD-202, unless otherwise noted. For amplifiers, see the table of environmental specifications at the beginning of the amplifier section of the Handbook.

| Rating or Test | MIL-STD-202 | | Package Type | | | |
|---|---|---|---|---|---|---|
| | Method | Condition | Hermetic | Nonhermetic | | |
| | | | | Metal | Plastic | Connectored |
| Temperature Operating, °C (1) | — | — | -55 to 100 | -55 to 100 | -22 to 85 | -55 to 100 |
| Temperature Storage, °C (1) | — | — | -55 to 100 | -55 to 100 | -55 to 100 | -55 to 100 |
| Altitude: 150,000 feet | 105 | E | Yes | Yes | Yes | Yes |
| Humidity: 90% RH, 65°C | 106 | — | Yes | Yes(2) | (3) | Yes (2) |
| Thermal Shock: -65 to 125°C | 107 | B | Yes | Yes | -55 to 100 | -55 to 100 |
| Fine Leak, atm-cc/s | 112 | C | $1x10^{-7}$ | Not Appl. | Not Appl. | Not Appl. |
| Gross Leak, atm-cc/s | 112 | D | $1x10^{-5}$ | Not Appl. | Not Appl. | Not Appl. |
| Drop: random, 45 minutes | 203 | — | Yes | Yes | Yes | Yes |
| Vibration: 2 to 2000 Hz, 20 G's, 12 hours | 204 | D | Yes | Yes | Yes | Yes |
| Solderability: 95% coverage | 208 | — | Yes | Yes | Yes | Not Appl. |
| Solder heat: 260°C 10 seconds | 210 | B | Yes | Yes | Yes | Not Appl. |
| Terminal tensile strength: 4-1/2 lbs, 10 seconds | 211 | A | Yes | Yes | Yes | Not Appl. |
| Terminal fatigue: 2 lbs 3 cycles | 211 | C | Yes | Yes | Yes | Not Appl. |
| Mechanical shock: 100 G's, 6ms | 213 | I | Yes | Yes | Yes | Yes |
| Solvent resistance | 215 | — | Yes | Yes | Yes | Not Appl |

***For surface mount models, see surface mount environmental specifications in General Information (section 0).***

Notes:
1. Extended temperature ranges are available for some models; consult factory
2. Nonhermetic metal-cased units may require bake-out after test to restore full performance
3. Humidity capabilities of plastic-cased units available on special request

CAPO now available! computer-automated performance data

## In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

# Product Testing For High Reliability

## Ultra-Rel

Mini-Circuit's mixers, phase detectors, frequency doublers and limiters are "Ultra-Rel": They carry a five-year guarantee, a reliability breakthrough attributed mainly to unique Ultra-Rel diodes that easily meet and exceed MIL-STD-883 tests. Each type of diode must pass the following grueling tests:

| | |
|---|---|
| LIFE | 1000 hrs. TA + 125°C, 50 mA ac |
| THERMAL SHOCK | -65° to +125°C, 200 cycles, 5 min. dwell |
| MECHANICAL SHOCK | 1.5k G's, 0.5 µsec pulse |
| VIBRATION | variable frequency 20 to 2,000 Hz. |
| TEMPERATURE CYCLE | -65°C to +125°C, 200 cycles, 10 min. dwell |
| AUTOCLAVE (pressure pot) | 14.7 psi, TA + 121°C, 96 hr. |
| 85/85 | 85°C/@85%humidity 168 hr., no bias |
| ACCELERATED HI-TEMPERATURE STORAGE | 300°C, 325°C, 350°C storage until 50% failures |

## HTRB Testing

Certain models, identified individually in the catalog, instead have their diodes subjected to high-temperature, reverse-bias (HTRB) testing. This is an accelerated-life screening test generally reserved for space applications. Here the Schottky and PIN diodes are subjected to a one volt negative bias at 150°C for 168 hours. The objective of this accelerated aging stress is to force time/temperature related failures and thus screen out potentially unreliable devices.

## /MIL, TX, and Hi-Rel Products

All hermetically sealed MCL models can be subjected to screening and to environmental testing. These tests are designed to eliminate early failures and to ensure performance in hostile environments. Many models having such testing performed are available from stock parts, designated by a /MIL, TX or Hi-Rel suffix to the model number. For your convenience, the table below summarizes availability and applicable MIL Spec by product line. A brief description of the test procedures follows the table.

Of course, if you have a specific screening requirement for any model, which is not available from a stock item, or for a non-hermetic model, contact our Applications Engineering staff and they will suggest the most cost-effective means of satisfying your reliability needs.

## /MIL Models

Mixers, Frequency Doublers and Phase Detectors are tested in accordance with MIL-M-28837. Pre-conditioning, Group A (screened) and Group B are performed on each inspection lot.

Power Splitters are tested in accordance with MIL-P-23971. Group A and Group B are performed on each inspection lot.

These models may be ordered by adding the suffix /MIL to the model number.

| Product Line | Applicable Suffix *TX | *Hi-Rel | */MIL | Applicable Std. or Specification for reference |
|---|---|---|---|---|
| Amplifiers | Not applicable | No | No | MIL-STD-883 |
| Digital Step Attenuators | Not applicable | No | No | MIL-STD-883 |
| Directional Couplers | Not applicable | Yes | No | MIL-C-15370 |
| Electronic Attenuators/ Switches | No | Yes | Yes | MIL-M-28837 |
| Filters | Not applicable | Yes | No | MIL-F-18327 |
| Fixed Attenuators | Not applicable | Yes | No | MIL-A-3933 |
| Frequency Doublers | Yes | Yes | Yes | MIL-M-28837 |
| I & Q Modulators and Demodulators | No | No | No | MIL-M-28837 |
| Limiters | No | No | No | MIL-M-28837 |
| Mixers | Yes | Yes | Yes | MIL-M-28837 |
| Phase Detectors | No | Yes | Yes | MIL-M-28837 |
| Phase Modulators | No | No | No | MIL-M-28837 |
| Power Splitter/ Combiners | Not applicable | Yes | Yes | MIL-P-23971 |
| Switches | Not applicable | Yes | No | MIL-STD-883 |
| Terminations | Not applicable | No | No | MIL-D-39030 |
| Transformers | Not applicable | Yes | No | MIL-T-55631 |

*Check with our Sales Department for specific models available as Hi-Rel. /MIL or TX..

Mini-Circuits®
P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## TX Models

TX Models employ hermetically sealed diodes which have passed the following tests in accordance with MIL-STD-750:

| | |
|---|---|
| 1) HIGH TEMP. STORAGE | Method 1032 |
| 2) TEMP. CYCLING | Method 1051, Cond. C |
| 3) CONSTANT ACCELERATION | Method 2006 (Y1 Orientation, 20,000 G's) |
| 4) FINE AND GROSS LEAK | Method 1071, Cond. C and H |
| 5) BURN-IN | Method 1038, Cond. B |

The end product is then further screened by being subjected to:

| | |
|---|---|
| 1) THERMAL SHOCK | MIL-STD-202, Method 107, Cond. A (100°C) |
| 2) BURN-IN | 96 hours at 100°C with 8mA at 1KHz |
| 3) FINE AND GROSS LEAK | MIL-STD-202, Method 112, Cond. C and D |

These models may be ordered by adding the suffix TX to the model number. Also, some models in the product lines having a "No" entry in the TX column of the table may be available with similar screening on special order.

## Hi-Rel Models

Mixers, Phase Detectors, Frequency Doublers and Electronic Attenuators/Switches are tested to the following per MIL-STD-202:

| | |
|---|---|
| 1) THERMAL SHOCK | Method 107, Cond. A (100°C) |
| 2) BURN-IN | Method 108, Cond. A (100°C, 8mA ac) |
| 3) FINE AND GROSS LEAK | Method 112, Cond. C and D |

Powersplitter/combiners, Directional Couplers, Transformers, Fixed Attenuators, Filters and Limiters are tested to the following per MIL-STD-202:

| | |
|---|---|
| 1) BAKE-IN | Method 108, Cond. A (100°C, no excitation) |
| 2) THERMAL SHOCK | Method 102, Cond. A (100°C) |
| 3) FINE & GROSS LEAK | Method 112, Cond. C and D |

Switches incorporating PIN diodes are tested to the following per MIL-STD-202, as a minimum:

| | |
|---|---|
| 1) THERMAL SHOCK | Method 107, Cond. A (100°C) |
| 2) BURN-IN | Method 108, Cond. A (100°C, diode current applied) |

For additional tests applicable to specific switch models, please consult our Sales Department.

These models may be ordered by adding the suffix Hi-Rel to the model number.

## Meeting Customer Needs

The following table outlines generic types of tests we do to satisfy customer's needs per specific contractual requirements. Each entry encompasses one or more QCPs (Quality Control Procedures) which are particularized as to test conditions. The principal MIL standards referenced in the QCPs are listed.

| QCP GROUP | TEST | METHODS OF MIL-STD -202 | -810 | -883 |
|---|---|---|---|---|
| 02-00 | THERMAL SHOCK | 107 | 503 | 1010 |
| 03-00 | RANDOM VIBRATION | 214 | | |
| 04-00 | MECHANICAL SHOCK | 207,213 | 516 | |
| 05-00 | CONSTANT ACCELERATION | 212 | | 2001 |
| 06-00 | BAKE-IN/BURN-IN | 108 | | 1015 |
| 07-00 | SEAL TESTS | 112 | | |
| 08-00 | MOISTURE RESISTANCE | 106 | 507 | |
| 09-00 | RADIOGRAPHIC | 209 | | 2012 |
| 10-00 | SINE VIBRATION | 201 | 514 | |
| 11-00 | HIGH FREQUENCY VIBRATION | 204 | | |
| 12-00 | HUMIDITY | 103 | | |
| 13-00 | ALTITUDE (BAROMETRIC PRESSURE) | 105 | 500 | |
| 14-00 | SALT-SPRAY | 101 | 509 | |
| 15-00 | TERMINAL STRENGTH | 211 | | |
| 16-00 | RESISTANCE TO SOLVENTS | 215 | | |
| 17-00 | SOLDERABILITY | 208 | | |
| 18-00 | RESISTANCE TO SOLDERING HEAT | 210 | | |
| 19-00 | IMMERSION | 104 | | |
| 20-00 | EXPLOSION | 109 | 511 | |
| 21-00 | SAND AND DUST | 110 | 510 | |
| 22-00 | FUNGUS TEST | | 508 | |
| 25-00 | PARTICLE IMPACT NOISE DETECTION (PIND) | | | 2020 |

## Connector Specifications

All coaxial connectors used in MCL products meet applicable requirements of MIL-C-39012 including mating compatibility, coupling proof torque, contact retention, materials and finish durability.

**In Stock...Immediate Delivery**

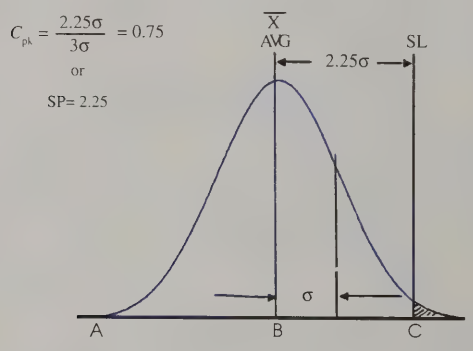
For custom versions of standard models consult our applications dept.

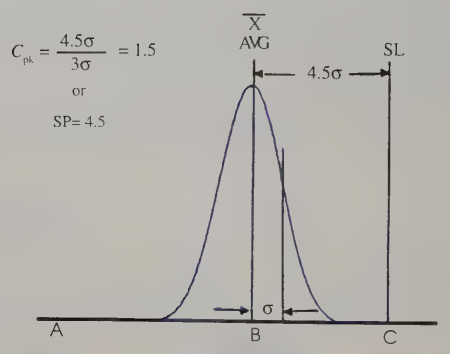
# statistical process control... key to competitive manufacturing

In today's tough world market environment, the need to be better is more demanding, and the need to be more competitive is a necessity to survive. A company cannot rest on the success of past performance and expect to continue to remain successful. There are many well known examples of companies both large and small that were once leaders in their field and now are skeletons of themselves or just plain dead and buried.

How does one get more competitive? The answer is simple. Exceed your customers' needs and expectations ...provide, in the manner required by the customer, a quality product at low cost, on time, every time. In most manufacturing organizations a significant cost factor is attributed to the cost of purchased materials and they may range from 25% to 80% of the cost of the entire product. Because of the significance of purchased material to total cost, the quality of the purchased material is important and essential to the competitiveness of the manufacturing organization.

This paper will discuss the effects of quality on the direct and indirect causes that contribute to the *real cost* of the purchased material. A measure of the quality of the material will be described by a quality factor, Cpk. The higher the value of Cpk, the better the quality of the product. Cpk is a measure of the repeatability of material performance. The higher the number, the better is the consistency of performance or the less is the variation in performance. Therefore, once designed in, the material should be consistent enough so that its variations are not transparent to the final product.




In manufacturing, variation is evil! If the value of Cpk for a purchased part is low, and Cpk varies from production lot-to-lot, then it can be projected the process for manufacturing the part is not in control, performance will be inconsistent, rejects can be expected, and the true cost of the purchased part will be significantly higher than the price shown on the purchase order.

With the abundance of low cost computers and hand held scientific calculators, the ability to calculate Cpk is easily attainable. Cpk is a quality factor that is based on the statistical calculation of mean value, $\overline{x}$ and standard deviation, sigma. Cpk is the difference in value between the mean value and the closest spec limit divided by 3 sigma.

$$\text{Cpk} = \frac{\text{(spec limit - mean value)}}{\text{3 sigma}}$$

At Mini-Circuits we use SP (Sigma Performance) = 3 times Cpk. We must *measure* variation to control it. If we can measure it we can tell when it gets better or worse. We need to know what works and what doesn't work. How much a manufacturing process varies is measured by Sigma (σ). In the figures shown, the average (AVG) tells us where the process is centered. The spread or width is measured by sigma. The figures show how the product is distributed. The height of the graph measures how often values occur. The spread measures how far the values are from the AVG. If the product is well controlled, there will be little variation, more values of units will occur nearer the target, $\overline{x}$, and sigma will be small.

Manufactured products are either good or bad depending on whether they do what the customer wants them to do. Specification limits *were* the measure of success, where product within spec was good and out of spec bad. It is not enough in today's market place to *just* meet spec! In the figures shown, a spec limit (SL) is compared to the product distribution. Product built outside, or to the right of the spec limit, is very bad; even product built just to the left of the spec limit is not good. Small (skinny) Sigma means the product will be far from the spec limit and close to the AVG value (very good product, what today's customers demand).

We can compare different processes by measuring variation and the distance from the average to the spec limit. But only if we measure the distance in terms if sigma, as shown in the figures. The real distance is the same for both figures (C-B), meaning both processes are centered and the AVG values are equal. But, in terms of product quality, the figure on the bottom is far superior (4.5>2.25) because the variation between units is much less as given by the skinnier value of sigma.

For convenience, we normalize by dividing the distance (C-B) by sigma (considered a relative ideal), and get the capability index, Cpk, a figure of merit. The skinnier the σ is, the higher the Cpk, and the less variation, unit-to-unit.



Mini-Circuits®
P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

The "goodness" of the purchased parts, Cpk, will affect the actual *real cost* of the purchased material. This real cost can vary and will depend on the original design and the specifications describing the purchased material. The real cost depends on the sum of both direct and indirect costs. These are:

*Costs additive to the cost of purchased parts:*

**A. Direct costs of poor quality parts:**

1. Warranty
2. Scrap and repair
3. Inspection/test

**B. Indirect costs of poor quality parts:**

1. Lost sales-customers switching to competition
2. Field trips, retrofits, settlements
3. Downtime, line shut downs, delinquencies, rescheduling
4. Inventory build-up, obsolete material, MRB, material expediting, material shrinkage
5. Engineering changes and redesign, documentation changes, material selection and separation

**C. Indirect costs, demands of the manufacturing system on company's resources**

1. Space
2. Manpower, receiving, production control, manufacturing, sales, finance, engineering, QA, accounting, maintenance, house cleaning
3. Utilities (lighting, heating, air conditioning, telephone)
4. Capital equipment (testing, incoming inspection and production, data processing)
5. Finances, cost to maintain higher inventory of material
6. Data processing and data entry

*Description of costs to the manufacturer of poor quality parts received.*

When poor quality parts are received, the manufacturer must maintain an incoming inspection department to check parts for conformance to specifications. *If* all parts were received with a Sigma Performance = 4.5 or, Cpk =1.5, then the demands for incoming inspection would evaporate. However, this is not the case in the real world today. Therefore, the cost of the inspection department is visually spread out and amortized as a percentage of the total cost of all material received. However, when poor quality parts are received, there are direct additional costs that are incurred by the manufacturing organization. These costs include additional testing and inspection so that additional manpower and capital equipment are required. In addition, there are added costs associated with documents DMR, RTV etc.; MRB meetings; purchasing costs such as expediting, search for alternatives, rescheduling and issuing of p.o. change orders; and engineering costs for evaluation and test.

In addition to incoming inspection costs, the delays of incoming material to the production floor will generate additional manufacturing costs. These include rescheduling and smaller production runs (less parts available); inefficiency of resources, such as manpower and machines, increased space requirements and WIP; increased material shrinkage and increased manufacturing throughput time.

The results of these manufacturing delays and costs will cause shipment delays and increased manufacturing costs that may be passed on to customers. Both factors contributing to a less competitive position!

To pursue Mini-Circuits' goal to exceed our customer's expectations, Mini-Circuits is striving to achieve an SP of 4.5 or, Cpk = 1.5. All mixer and I&Q modulator conversion loss is specified in statistical terms. We are vigorously pursuing statistical process control and statistical specifications on all our products to enable our customers to receive the highest quality and value, at the lowest cost... the key to competitive manufacturing.

CAPO now available! computer-automated performance data

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

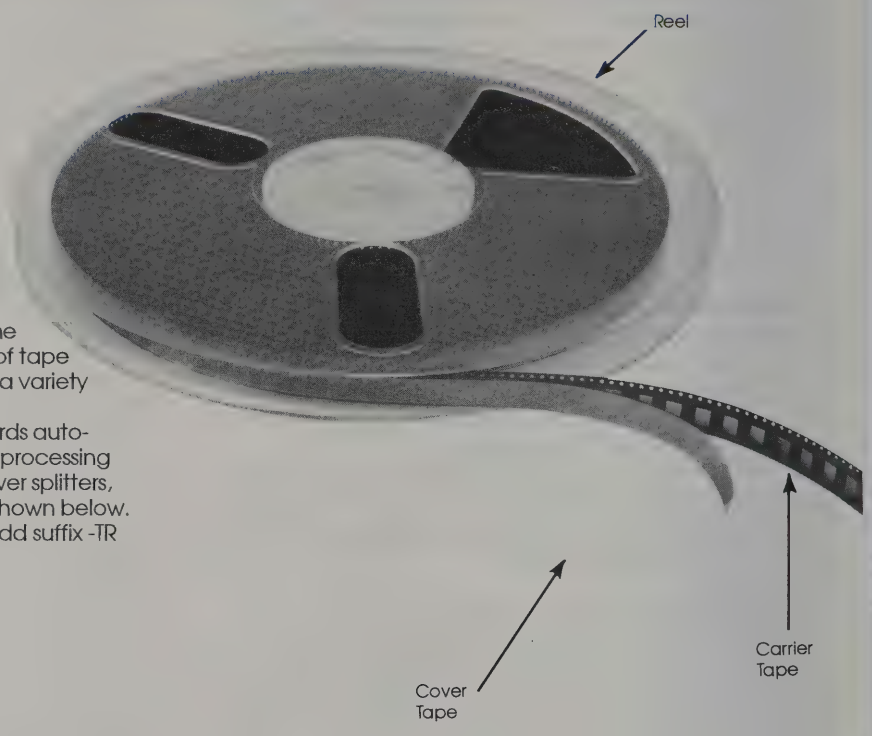
# tape and reel packaging for surface mount devices

Design-For-Assembly (DFA) and Design-For-Manufacture (DFM) stand tall alongside CAD/CAM in the quest to optimize profitability, production efficiency and equipment operating usage.

Automation of surface-mount assembly by the use of pick-and-place equipment to handle tiny components has been enhanced by evolutionary improvements in tape-and-reel systems which can accommodate as many as 4000 parts on a 13-inch reel. This results in less frequent component reloading and less downtime of the assembly equipment. Other advantages of tape feeders include versatility or the ability to handle a variety of parts.

Mini-Circuits has kept pace with the trend towards automated assembly and offers RF/Microwave signal-processing components (mixers, amplifiers, transformers, power splitters, switches and others) in tape-and-reel format as shown below.

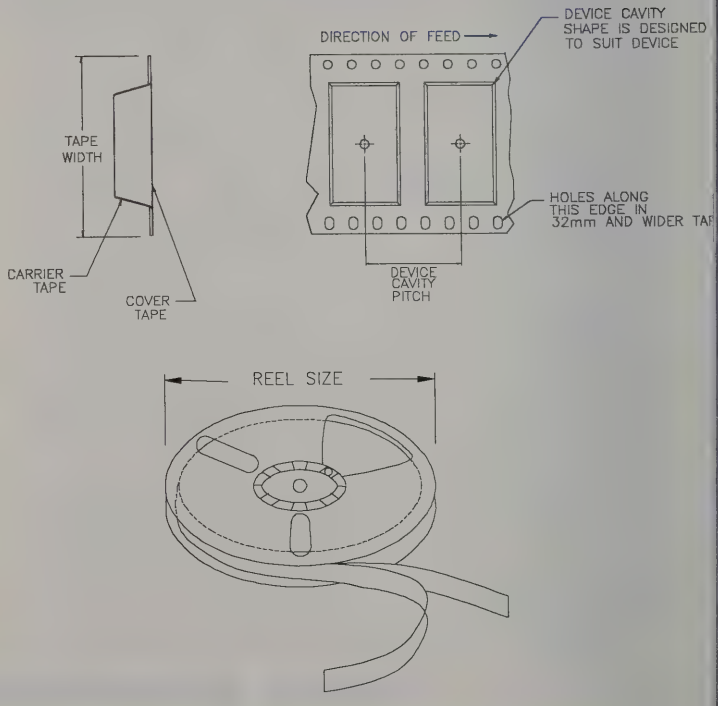
To order a tape-and-reel packaged product, add suffix -TR to its model number.




## packaging information

| Packaging Part No. | Case Style | Tape Width (mm) | Reel Size (inches) | Device Cavity Pitch (mm) | Devices per Reel | Orientation Figure No. |
|---|---|---|---|---|---|---|
| F1 | KK81 | 24 | 13 | 12 | 500 | T-001 |
| F2 | TT100 | 16 | 13 | 12 | 500 | T-002 |
| F3 | TT240 | 16 | 13 | 12 | 500 | T-002 |
| F4 | WW107 | 12 | 7 | 8 | 1000 | T-003 |
| F5 | YY101 | 32 | 13 | 16 | 500 | T-004 |
| F6 | YY161 | 32 | 13 | 16 | 500 | T-004 |
| F7 | KKK155 | 24 | 13 | 16 | 500 | T-005 |
| F8 | MMM168 | 8 | 7 | 4 | 3000 | T-006 |
| F9 | NNN150 | 24 | 13 | 16 | 500 | T-007 |
| F10 | QQQ130 | 24 | 13 | 16 | 500 | T-008 |
| F11 | RRR137 | 12 | 7 | 8 | 500 | T-009 |
| F12 | TTT166 | 24 | 13 | 12 | 500 | T-010 |
| F13 | TTT167 | 24 | 13 | 12 | 500 | T-010 |
| F14 | AF190 | 12 | 7 | 8 | 500,1000 | T-011 |
| F15 | AG191 | 16 | 13 | 12 | 500 | T-005 |
| F16 | XX211 | 12 | 7 | 8 | 500 | T-004 |
| F17 | AT224 | 12 | 7 | 8 | 500 | T-012 |
| F18 | AN213 | 24 | 13 | 16 | 500 | T-013 |
| F19 | XX112 | 16 | 7 | 8 | 500 | T-014 |
| F20 | CTT248 | 16 | 13 | 12 | 500 | T-002 |
| F21 | BG291 | 32 | 13 | 32 | 200 | T-015 |
| F22 | BK276 | 32 | 13 | 16 | 500 | T-015 |
| F23 | BJ293 | 24 | 13 | 16 | 500 | T-015 |
| F24 | BH292 | 16 | 13 | 12 | 500 | T-015 |
| F25 | BL301 | 44 | 13 | 32 | 130 | T-015 |
| F26 | AF320 | 12 | 7 | 8 | 1000 | T-011 |
| F27 | BK343 | 32 | 13 | 16 | 500 | T-015 |
| F28 | BK377 | 32 | 13 | 20 | 500 | T-015 |
| F29 | BJ398 | 24 | 13 | 12 | 500 | T-015 |

## tape illustration






Mini-Circuits®
P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

Fig. T-001

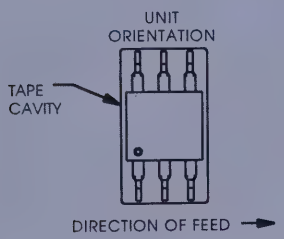



Fig. T-002

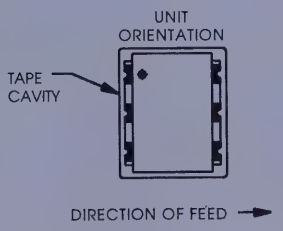



Fig. T-003

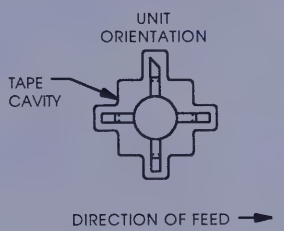



Fig. T-004

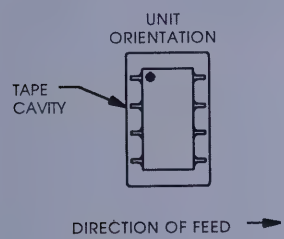



Fig. T-005

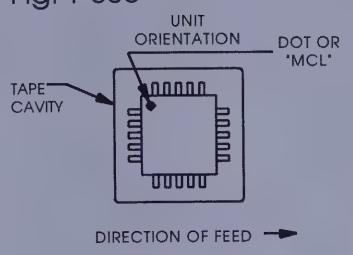



Fig. T-006

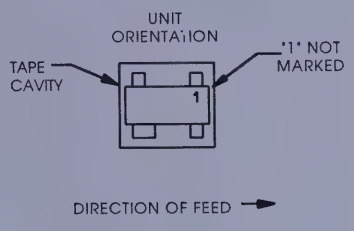



Fig. T-007

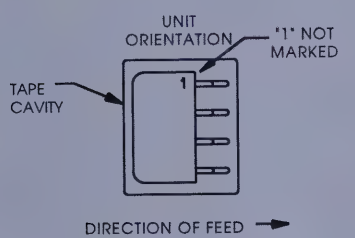



Fig. T-008

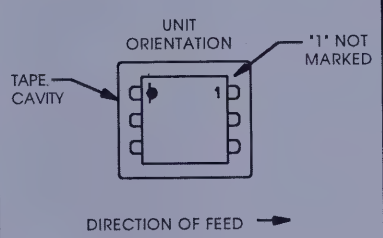



Fig. T-009

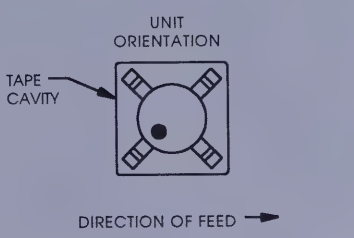



Fig. T-010

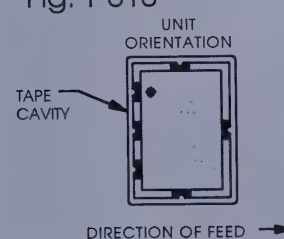



Fig. T-011

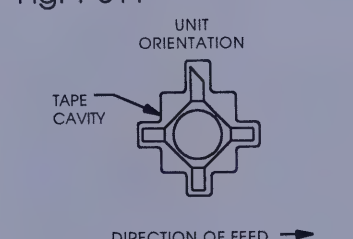



Fig. T-012

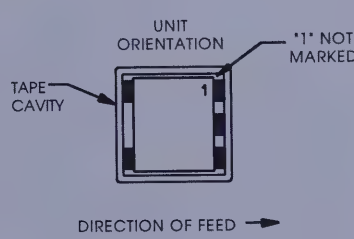



Fig. T-013

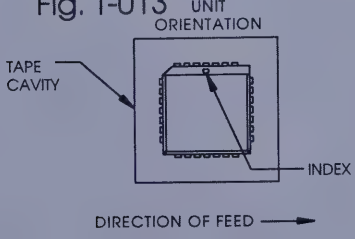



Fig. T-014

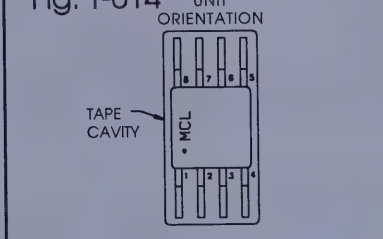
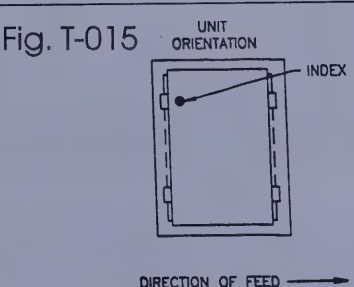
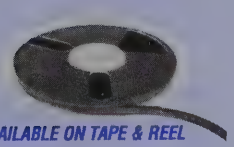



Fig. T-015




ALL CATALOG ITEMS GUARANTEED TO BE *SHIPPED WORLDWIDE WITHIN 1 WEEK!*

FOR CUSTOM PRODUCTS AT CATALOG PRICES CONTACT OUR APPLICATIONS DEPT.



*AVAILABLE ON TAPE & REEL*

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A01 | .770<br>19.56 | .800<br>20.32 | .385<br>9.78 | .400<br>10.16 | .370<br>9.40 | .400<br>10.16 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | .031<br>.79 | | | | | | | | | 5.2 | A1,B3,E1,B7 |
| A03 | .480<br>12.19 | .500<br>12.70 | .390<br>9.91 | .405<br>10.29 | .210<br>5.33 | .230<br>5.84 | .100<br>2.54 | .20<br>5.08 | .14<br>3.56 | .020<br>.51 | | | | | | | | | 2.3 | A1,B4,E1,B7 |
| A04 | .770<br>19.56 | .800<br>20.32 | .200<br>5.08 | .210<br>5.33 | .370<br>9.40 | .400<br>10.16 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | .031<br>.79 | | | | | | | | | 3.7 | A1,B3,E1,B7 |
| A05 | .770<br>19.56 | .800<br>20.32 | .240<br>6.10 | .250<br>6.35 | .370<br>9.40 | .400<br>10.16 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | .031<br>.79 | | | | | | | | | 3.7 | A1,B3,E1,B7 |
| A06 | .770<br>19.56 | .800<br>20.32 | .285<br>7.24 | .310<br>7.87 | .370<br>9.40 | .400<br>10.16 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | .031<br>.79 | | | | | | | | | 5.2 | A1,B3,E1,B7 |
| A11 | .480<br>12.19 | .500<br>12.70 | .240<br>6.10 | .255<br>6.48 | .210<br>5.33 | .230<br>5.84 | .100<br>2.54 | .20<br>5.08 | .14<br>3.56 | .020<br>.51 | | | | | | | | | 1.9 | A1,B4,E1,B7 |
| B02 | .480<br>12.19 | .500<br>12.70 | .240<br>6.10 | .255<br>6.48 | .210<br>5.33 | .230<br>5.84 | .16<br>4.06 | .100<br>2.54 | .14<br>3.56 | .20<br>5.08 | .020<br>.51 | | | | | | | | 1.9 | A1,B4,E1,B7 |
| B13 | .480<br>12.19 | .500<br>12.70 | .390<br>9.91 | .405<br>10.29 | .210<br>5.33 | .230<br>5.84 | .16<br>4.06 | .100<br>2.54 | .14<br>3.56 | .20<br>5.08 | .020<br>.51 | | | | | | | | 2.3 | A1,B4,E1,B7 |
| C07 | .770<br>19.56 | .810<br>20.57 | .380<br>9.65 | .410<br>10.41 | .030<br>.76 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | | | | | | | | | | | 11.0 | A1,E1,B7 |
| C145 | .770<br>19.56 | .810<br>20.57 | .380<br>9.65 | .410<br>10.41 | .030<br>.76 | .200<br>5.08 | .20<br>5.08 | .14<br>3.56 | | | | | | | | | | | 11.0 | A1,E1,B7 |
| D08 | 1.000<br>25.40 | 1.025<br>26.04 | .390<br>9.91 | .430<br>10.92 | .500<br>12.70 | .525<br>13.34 | .025<br>.64 | .300<br>7.62 | .200<br>5.08 | .09<br>2.29 | .13<br>3.30 | .150<br>3.81 | .20<br>5.08 | .14<br>3.56 | | | | | 8.5 | A1,E1,B7 |
| D09 | 1.000<br>25.40 | 1.025<br>26.04 | .240<br>6.10 | .280<br>7.11 | .500<br>12.70 | .525<br>13.34 | .025<br>.64 | .300<br>7.62 | .200<br>5.08 | .09<br>2.29 | .13<br>3.30 | .150<br>3.81 | .20<br>5.08 | .14<br>3.56 | | | | | 7.5 | A1,E1,B7 |
| E10 | 1.580<br>40.13 | 1.620<br>41.15 | .380<br>9.65 | .410<br>10.41 | .770<br>19.56 | .810<br>20.57 | .030<br>.76 | .200<br>5.08 | .10<br>2.54 | .20<br>5.08 | .14<br>3.56 | | | | | | | | 23.0 | A1,E1,B7 |
| F14 | 2.00<br>50.80 | 2.00<br>50.80 | .75<br>19.05 | 1.00<br>25.40 | .25<br>6.35 | 1.500<br>38.10 | .125<br>3.18 | .39<br>9.91 | 1.00<br>25.40 | .50<br>12.70 | 1.00<br>25.40 | | | | | | | | 170.0 | A10,<br>C1,D2 |
| F53 | 2.00<br>50.80 | 2.0<br>50.80 | .75<br>19.05 | 1.00<br>25.40 | .13<br>3.30 | 1.750<br>44.45 | .125<br>3.18 | .39<br>9.91 | 1.00<br>25.40 | .50<br>12.70 | 1.00<br>25.40 | | | | | | | | 170.0 | A10<br>C1,D2 |
| F183 | 1.26<br>32.00 | 1.00<br>25.40 | .70<br>17.78 | .200<br>5.08 | .200<br>5.08 | .860<br>21.84 | .125<br>3.18 | .35<br>8.89 | .63<br>16.00 | .38<br>9.65 | .50<br>12.70 | | | | | | | | 24 | A4,B1,D17 |
| G15 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | .61<br>15.49 | —<br>— | .80<br>20.32 | .80<br>20.32 | .76<br>19.30 | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 85.0 | A10,A18,B1,<br>D1,D7 |
| G144 | 1.25<br>31.75 | 1.25<br>31.75 | —<br>— | .63<br>16.00 | .38<br>9.65 | .61<br>15.49 | —<br>— | —<br>— | —<br>— | .76<br>19.30 | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 85.0 | A10,A18,<br>B6,D6 |
| H16 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | 1.000<br>25.40 | .125<br>3.18 | 1.000<br>25.40 | —<br>— | —<br>— | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 70.00 | A10,A18,B1,<br>D2,D3,D4 |
| J17 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | 1.000<br>25.40 | .125<br>3.18 | 1.000<br>25.40 | —<br>— | —<br>— | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 75.0 | A10,A18,<br>B1,D2,D3 |
| K18 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | 1.000<br>25.40 | .125<br>3.18 | 1.000<br>25.40 | —<br>— | —<br>— | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 70.0 | A10,A18,B1,<br>C1,D2,D3 |
| L19 | 1.50<br>38.10 | 1.13<br>28.70 | 1.00<br>25.40 | .50<br>12.70 | .155<br>3.94 | 2.345<br>59.56 | .138<br>3.51 | .987<br>25.07 | 2.50<br>63.50 | .10<br>2.54 | .31<br>7.87 | 1.19<br>30.23 | —<br>— | .66<br>16.76 | —<br>— | —<br>— | .150<br>3.81 | | 37.0 | A6,A11,A18,<br>B2,D6 |
| L20 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .10<br>2.54 | .40<br>10.16 | 1.86<br>47.24 | —<br>— | .64<br>16.26 | —<br>— | —<br>— | .150<br>3.81 | | 74.0 | A6,A11,A18,<br>B2,D5 |
| M21 | 1.50<br>38.10 | 1.13<br>28.70 | 1.00<br>25.40 | .50<br>12.70 | .155<br>3.94 | 2.345<br>59.56 | .138<br>3.51 | .987<br>25.07 | 2.50<br>63.50 | .10<br>2.54 | .31<br>7.87 | .75<br>19.05 | 1.19<br>30.23 | .66<br>16.76 | —<br>— | —<br>— | .150<br>3.81 | | 40.0 | A6,A11,A18,<br>B2,C1,D6 |
| M22 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .10<br>2.54 | .40<br>10.16 | 1.15<br>29.21 | 1.86<br>47.24 | .64<br>16.26 | —<br>— | —<br>— | .150<br>3.81 | | 74.0 | A6,A11,A18,<br>B2,C1,D5 |
| M23 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .10<br>2.54 | .63<br>16.00 | 1.06<br>26.92 | 1.63<br>41.40 | .69<br>17.53 | —<br>— | —<br>— | .150<br>3.81 | | 70.0 | A6,A11,A18,<br>B2,C1,D6 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

### * NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C.R.S. Pin material: #52 alloy. Finish: electro tin, hot-oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: iridite per MIL-C-5541
- A6. Case material: aluminum alloy. Finish: blue paint over iridite.
- A10. Case material: aluminum alloy. Finish: grey paint or yellow iridite.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A18. Mounting bracket finish: iridite or clear anodize.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.
- B3. Insulated spacer available. Request P/N B14-045-01.
- B4. Insulated spacer available. Request P/N B-14-047-01.
- B6. Bracket version only.
- B7. Pin's meniscus (of header): 0.015" max.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.

D. CONNECTORS
- D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request, consult factory.
- D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC, SMA and Type N, consult factory. (ZAPD -4 units not available with BNC).
- D3. For Bracket Version, Option B, this dimension, "C", changes from 0.75 to 0.94 inches.
- D4. FTB Models available:
  - *A15 female BNC/isolated female BNC.
  - *C15 male BNC/isolated female BNC.

  FT Models available:
  - *A16 female BNC/female BNC 75 ohms.
  - *B16 female BNC/male BNC 75 ohms.
  - *C16 male BNC/female BNC 75 ohms.
- D5. Connectors: BNC standard, TNC consult factory.
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D7. For ZFSC-5 a fifth connector is offered as Port 5 in-line and opposite of sum(s) port.
- D17. Connectors: Female SMA only.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.

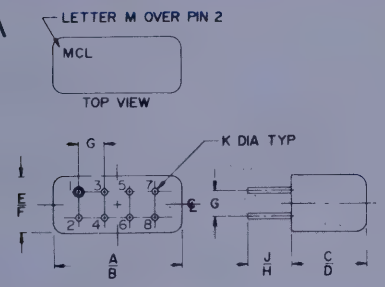


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# outline drawings

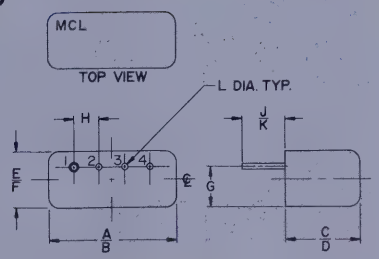
Mini-Circuits

## A



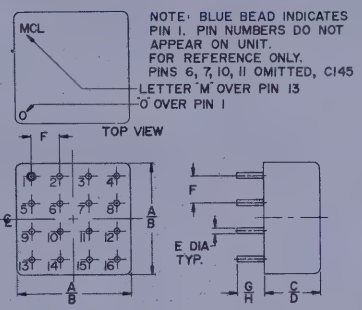

NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit
*For reference only*

## B

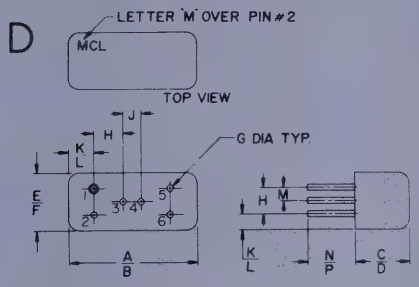



NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
*For reference only.*

## C

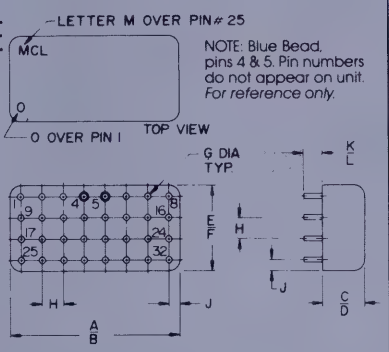



## D

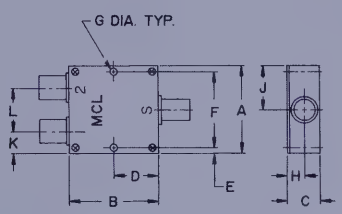



NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
*For reference only.*

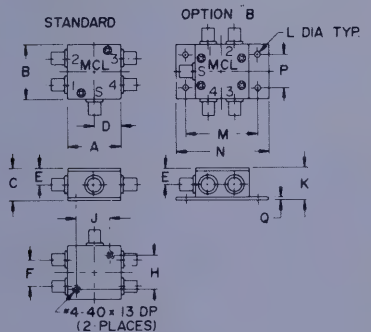
## E



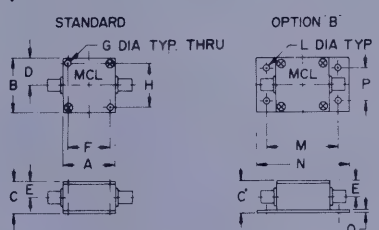

## F



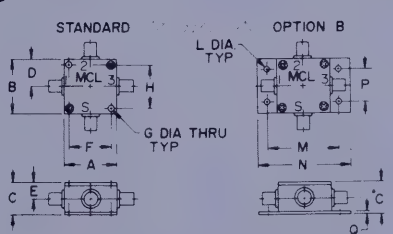

## G



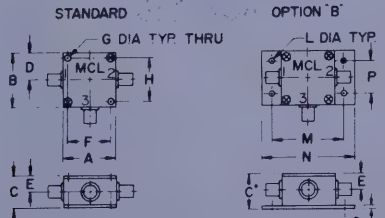

## H



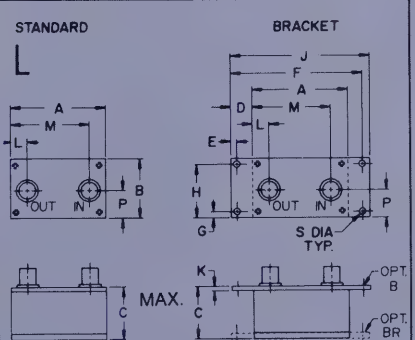

## J



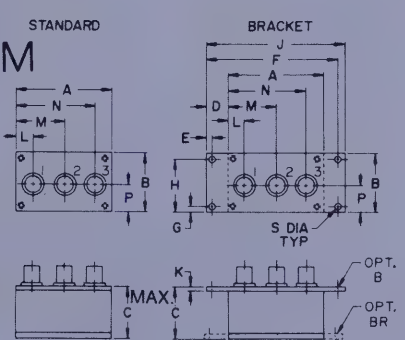

## K




## L




## M




CAPD now available! computer-automated performance data

## In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N24 | 1.50<br>38.10 | 1.13<br>28.70 | 1.00<br>25.40 | .50<br>12.70 | .155<br>3.94 | 2.345<br>59.56 | .138<br>3.51 | .987<br>25.07 | 2.50<br>63.50 | .10<br>2.54 | .32<br>8.13 | .75<br>19.05 | 1.18<br>29.97 | .31<br>7.87 | .56<br>14.22 | .81<br>20.57 | .150<br>3.81 | | 45.0 | A6, A11, A18, B2, D6 |
| N27 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .10<br>2.54 | .48<br>12.19 | 1.13<br>28.70 | 1.78<br>45.21 | .36<br>9.14 | .69<br>17.53 | 1.01<br>25.65 | .150<br>3.81 | | 92.0 | A6, A11, A18, B2, D8 |
| P25 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .10<br>2.54 | .78<br>19.81 | 1.47<br>37.34 | —<br>— | .38<br>9.65 | 1.00<br>25.40 | —<br>— | .150<br>3.81 | | 86.0 | A6, A11, A18, B2, D8 |
| P26 | 1.50<br>38.10 | 1.13<br>28.70 | 1.00<br>25.40 | .50<br>12.70 | .155<br>3.94 | 2.345<br>59.56 | .138<br>3.51 | .987<br>25.07 | 2.50<br>63.50 | .10<br>2.54 | .50<br>12.70 | 1.00<br>25.40 | —<br>— | .31<br>7.87 | .81<br>20.57 | —<br>— | .150<br>3.81 | | 42.5 | A6, A11, A18, B2, D6 |
| Q28 | 4.06<br>103.12 | 1.60<br>40.64 | 1.50<br>38.10 | 3.56<br>90.42 | .24<br>6.10 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .4<br>10.16 | .69<br>17.53 | .58<br>14.73 | .66<br>16.76 | 3.13<br>79.50 | .8<br>20.32 | .06<br>1.53 | | | | 300.0 | A10, A18, D9 |
| R29 | 4.06<br>103.12 | 1.60<br>40.64 | 1.50<br>38.10 | 3.56<br>90.42 | .24<br>6.10 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .4<br>10.16 | .69<br>17.53 | .58<br>14.73 | .66<br>16.76 | 3.13<br>79.50 | .8<br>20.32 | .06<br>1.53 | | | | 300.0 | A10, A18, C2, D9 |
| R30 | 6.69<br>169.93 | 1.60<br>40.64 | 1.50<br>38.10 | 6.22<br>157.99 | .24<br>6.10 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .40<br>10.16 | .69<br>17.53 | .55<br>13.97 | .66<br>16.76 | 5.72<br>145.29 | .81<br>20.57 | .06<br>1.53 | | | | 500.0 | A5, A18, C2, D9 |
| R31 | 9.31<br>236.47 | 1.60<br>40.64 | 1.50<br>38.10 | 8.84<br>224.54 | .24<br>6.10 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .40<br>10.16 | .69<br>17.53 | .54<br>13.72 | .66<br>16.76 | 8.34<br>211.84 | .81<br>20.57 | .06<br>1.53 | | | | 700.0 | A5, A18, C2, D9 |
| R67 | 6.69<br>169.93 | 1.60<br>40.64 | 1.50<br>38.10 | 6.22<br>157.99 | .24<br>6.10 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .40<br>10.16 | .69<br>17.53 | 1.22<br>30.99 | .66<br>16.76 | 5.72<br>145.29 | .81<br>20.57 | .06<br>1.53 | | | | 500.0 | A5, A18, D9 |
| S32 | 3.75<br>95.25 | 2.00<br>50.80 | 1.8<br>45.72 | .19<br>4.83 | 3.375<br>85.72 | .19<br>4.83 | 1.625<br>41.27 | .156<br>3.96 | .6<br>15.24 | .4<br>10.16 | .5<br>12.70 | 1.30<br>33.02 | .09<br>2.29 | .38<br>9.65 | 3.00<br>76.20 | .30<br>7.62 | 2.60<br>66.04 | | 220.0 | A7, A18, D9 |
| T34 | 4.75<br>120.65 | 2.00<br>50.80 | 2.21<br>56.13 | .19<br>4.83 | 4.375<br>111.13 | .23<br>5.84 | 1.540<br>39.12 | .144<br>3.66 | .58<br>14.73 | .34<br>8.64 | .50<br>12.70 | 1.50<br>38.10 | 1.00<br>25.40 | .12<br>3.05 | .38<br>9.65 | 4.00<br>101.60 | .30<br>7.62 | 2.60<br>66.04 | 440.0 | A7, A8, A18, D16 |
| T35 | 4.75<br>120.65 | 2.00<br>50.80 | 2.40<br>60.96 | .19<br>4.83 | 4.375<br>111.13 | .23<br>5.84 | 1.540<br>39.12 | .144<br>3.66 | .58<br>14.73 | .34<br>8.64 | .50<br>12.70 | 1.50<br>38.10 | 1.00<br>25.40 | .12<br>3.05 | .38<br>9.65 | 4.00<br>101.60 | 1.50<br>38.10 | 5.00<br>127.00 | 700.0 | A7, A8, A18, D16 |
| U36 | 7.00<br>177.80 | 3.25<br>82.55 | 2.13<br>54.10 | .25<br>6.35 | 6.500<br>165.10 | .38<br>9.65 | 2.500<br>63.50 | .156<br>3.96 | .73<br>18.54 | .88<br>22.35 | .63<br>16.00 | 1.13<br>28.70 | 2.23<br>56.64 | .125<br>3.17 | .50<br>12.70 | 6.00<br>152.40 | | | 900.0 | A7, A8, A18, D6 |
| U111 | 7.00<br>177.80 | 3.25<br>82.55 | 3.13<br>79.50 | .25<br>6.35 | 6.500<br>165.10 | .38<br>9.65 | 2.500<br>63.50 | .156<br>3.96 | .43<br>10.92 | .88<br>22.35 | .63<br>16.00 | 1.00<br>25.40 | 2.63<br>66.80 | .125<br>3.17 | .50<br>12.70 | 6.00<br>152.40 | 2.23<br>56.64 | | 1100.0 | A8, A18, D6 |
| U200 | 7.00<br>177.80 | 3.25<br>82.55 | 2.13<br>54.10 | .25<br>6.35 | 6.500<br>165.10 | .38<br>9.65 | 2.500<br>63.50 | .156<br>3.96 | .53<br>13.46 | .73<br>18.54 | .20<br>5.08 | .70<br>17.78 | 1.25<br>31.75 | .125<br>3.17 | .50<br>12.70 | 6.00<br>152.40 | 2.15<br>54.61 | .50<br>12.70 | 1000.0 | A7, A18, D6 |
| V37 | .83<br>21.08 | .83<br>21.08 | .75<br>19.05 | .37<br>9.40 | .42<br>10.67 | 1.25<br>31.75 | .100<br>2.54 | 1.150<br>29.21 | .095<br>2.41 | .735<br>18.67 | .21<br>5.33 | .106<br>2.69 | .06<br>1.52 | | | | | | 34.0 | A10, A18, C1, D17 |
| W38 | .30<br>7.62 | .27<br>6.86 | .23<br>5.84 | .010<br>0.25 | .042<br>1.07 | .020<br>0.51 | .100<br>2.54 | .05<br>1.27 | .09<br>2.29 | .37<br>9.40 | .036<br>0.91 | | | | | | | | .50 | A3, E2 |
| X65 | .30<br>7.62 | .27<br>6.86 | .23<br>5.84 | .010<br>0.25 | .042<br>1.07 | .020<br>0.51 | .100<br>2.54 | .05<br>1.27 | .04<br>1.02 | .12<br>3.05 | .300<br>7.62 | .35<br>8.89 | | | | | | | .50 | A3, E2 |
| Y39 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .36<br>9.15 | 1.000<br>25.4 | 1.000<br>25.4 | .125<br>3.2 | .125<br>3.2 | .46<br>11.7 | 2.18<br>55.4 | 1.688<br>42.9 | .07<br>1.8 | .750<br>19.0 | .50<br>12.7 | .80<br>20.3 | .45<br>11.4 | .29<br>7.4 | 50.0 | A4, A18, B1, D6, D22 |
| Y460 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .36<br>9.15 | 1.000<br>25.4 | 1.000<br>25.4 | .125<br>3.2 | .125<br>3.2 | .46<br>11.7 | 2.18<br>55.4 | 1.688<br>42.9 | .07<br>1.8 | .750<br>19.0 | .50<br>12.7 | .80<br>20.3 | .45<br>11.4 | .29<br>7.4 | 50.0 | A4, A18, B1, D6 |
| Z40/Z41 | 7.06<br>179.32 | 3.13<br>79.50 | .88<br>22.35 | .250<br>6.35 | 1.750<br>44.45 | 5.310<br>134.87 | 6.810<br>172.97 | .250<br>6.35 | 2.875<br>73.03 | .144<br>3.66 | 3.53<br>89.66 | .44<br>11.18 | .415<br>10.54 | .89<br>22.61 | | | | | 800.0 | A10, D11<br>A4(Z41) |
| Z54 | 3.50<br>88.90 | 2.13<br>54.10 | .88<br>22.35 | .250<br>6.35 | —<br>— | —<br>— | 3.250<br>82.55 | —<br>— | —<br>— | .125<br>3.17 | 1.750<br>44.45 | .44<br>11.18 | .415<br>10.54 | .89<br>22.61 | .250<br>6.35 | 1.813<br>46.05 | | | 250 | A10, D11 |
| Z184 | 2.26<br>57.40 | 2.00<br>50.80 | .70<br>17.78 | .200<br>5.08 | —<br>— | —<br>— | 2.060<br>52.32 | —<br>— | —<br>— | .125<br>3.17 | 1.13<br>28.70 | .35<br>8.89 | .38<br>9.65 | .500<br>12.70 | .200<br>5.08 | —<br>— | | | 59 | A4, D17 |
| Z259 | 7.06<br>179.32 | 3.13<br>79.50 | .88<br>22.35 | .250<br>6.35 | 1.750<br>44.45 | 5.310<br>134.87 | 6.810<br>172.97 | .312<br>7.92 | 2.875<br>73.03 | .144<br>3.66 | 3.53<br>89.66 | .44<br>11.18 | 1.31<br>33.27 | .89<br>22.61 | | | | | 800 | A4, C2 D24 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

## * NOTES:

A. MATERIAL AND FINISH
- A3. Case material: epoxy. Pin material: iron-nickel alloy. Finish: bright tin-plate per MIL-T-10727
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A5. Case material: C. R. S. Finish: grey paint over hot-tin dip.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate iridite per MIL-C-5541.
- A8. Case material: aluminum alloy. Finish: case irridite. Heat sink: black anodize.
- A10. Case material: aluminum alloy. Finish: grey paint, or yellow iridite.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A18. Mounting bracket finish: irridite or clear anodize.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.
- C2. Consecutive marking, n = no. of way power-splitter.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D8. Connectors: BNC only.
- D9. Connectors: BNC standard. TNC or Female SMA on request, consult factory.
- D11. Connectors: Please specify; Type N or SMA.
- D16. Connectors: Please specify, unless otherwise noted SMA is standard for model ZHL-2-12 for all other models BNC is standard. TNC, N, or SMA available on request. consult factory.
- D17. Connectors: Female SMA only.
- D22. Gain Control Terminal on Models ZFL-1000G and ZFL-1000GH only.
- D24. Connectors: Female BNC standard. Type N or SMA consult factory.

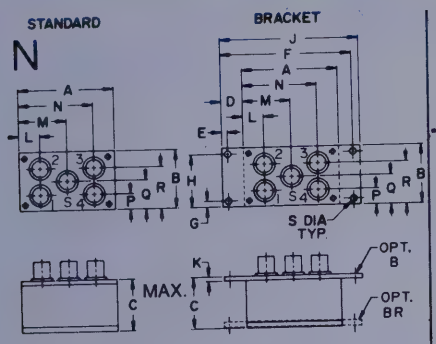
E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch.

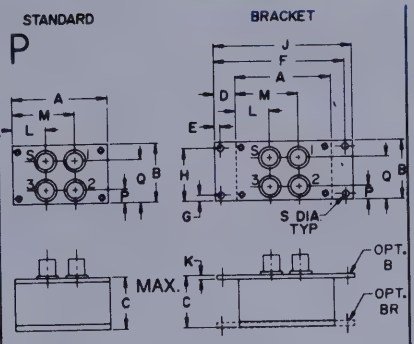


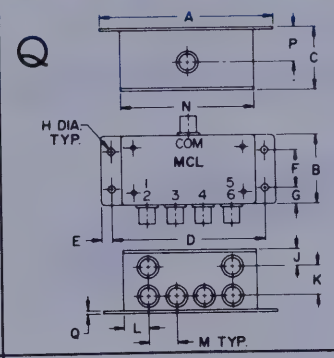
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

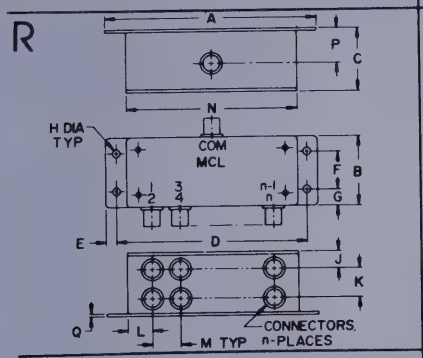
# outline drawings

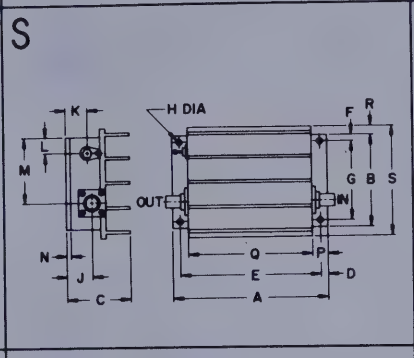
Mini-Circuits

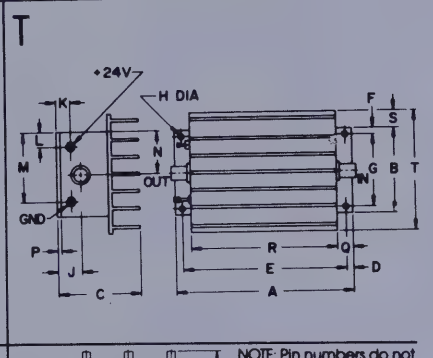


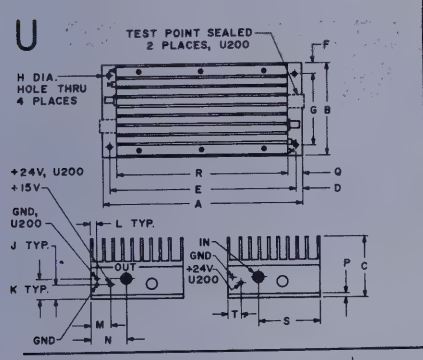



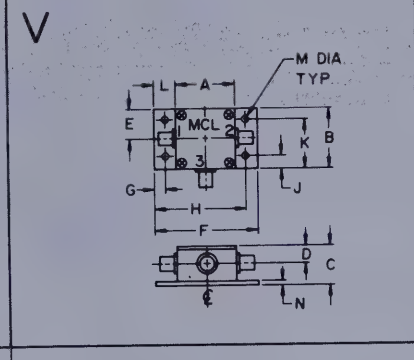



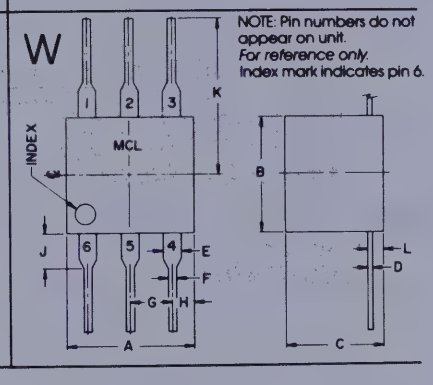



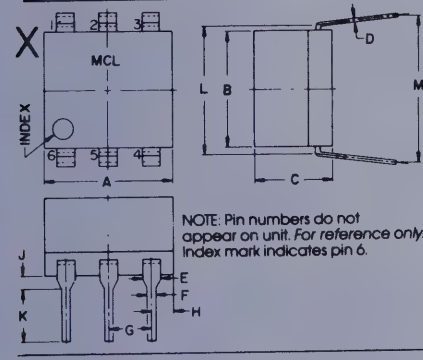



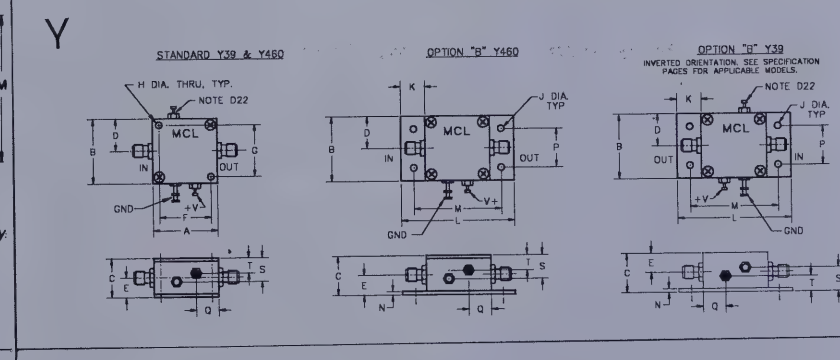



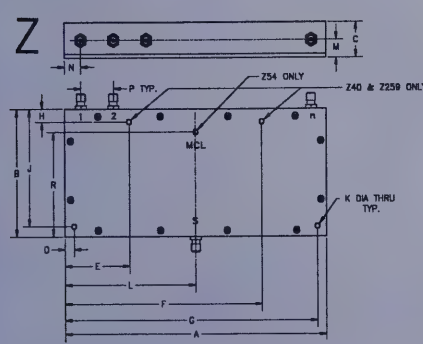




## In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

CAPO now available! computer-automated performance data

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AB185 | 4.76<br>120.90 | 3.00<br>76.20 | .53<br>13.46 | .150<br>3.81 | 4.610<br>117.09 | 1.500<br>38.10 | .125<br>3.18 | .50<br>12.70 | .25<br>6.35 | 1.13<br>28.70 | .500<br>12.70 | | | | | | | | 183 | A4, D17 |
| AB186 | 4.76<br>120.90 | 3.00<br>76.20 | .53<br>13.46 | .150<br>3.81 | 4.610<br>117.09 | 1.500<br>38.10 | .125<br>3.18 | .38<br>9.65 | .25<br>6.35 | .88<br>22.35 | .500<br>12.70 | | | | | | | | 153 | A4, D17 |
| AB204 | 6.13<br>155.70 | 3.00<br>76.20 | .53<br>13.46 | .162<br>4.11 | 5.962<br>151.43 | 1.500<br>38.10 | .116<br>2.95 | .50<br>12.70 | .25<br>6.35 | 1.13<br>28.70 | .50<br>12.70 | | | | | | | | 215 | A4, C2, D17 |
| AF190 | .180<br>4.57 | .090<br>2.29 | .020<br>.51 | .100<br>2.54 | .083<br>2.11 | .076<br>1.93 | .005<br>.13 | .022<br>.56 | .210<br>5.33 | .060<br>1.52 | .060<br>1.52 | .060<br>1.52 | .020<br>0.51 | | | | | | .04 | A16, C6, E3, F14 |
| AF320 | .200<br>5.08 | .100<br>2.54 | .020<br>.51 | .070<br>1.78 | .068<br>1.73 | .057<br>1.45 | .005<br>.13 | .020<br>.51 | .230<br>5.84 | .065<br>1.65 | .060<br>1.52 | .080<br>2.03 | .036<br>0.91 | | | | | | .04 | A28, C6, E3, F26 |
| AG191 | .310<br>7.87 | .400<br>10.16 | .095<br>2.41 | .003<br>.08 | .007<br>.18 | .035<br>.89 | .055<br>1.40 | .020<br>.51 | .050<br>1.27 | | | | | | | | | | .40 | A17, C7, E4, F15 |
| AH202 | .375<br>9.53 | .500<br>12.70 | .25<br>6.35 | .020<br>.51 | .035<br>.89 | .050<br>1.27 | .140<br>3.56 | .180<br>4.57 | .320<br>8.13 | .360<br>9.14 | .450<br>11.43 | .465<br>11.81 | .095<br>2.41 | .135<br>3.43 | .240<br>6.10 | .280<br>7.11 | | | .80 | A19 |
| AN213 | .456<br>11.58 | .487<br>12.37 | .170<br>4.32 | .020<br>.51 | .029<br>.74 | .017<br>.43 | .050<br>1.27 | .035<br>.89 | | | | | | | | | | | 2.0 | A23, E6, F18 |
| AR214 | 2.25<br>57.15 | 1.38<br>35.05 | 1.25<br>31.75 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .12<br>3.05 | .69<br>17.53 | 1.50<br>38.10 | .30<br>7.62 | .41<br>10.41 | .71<br>18.03 | .41<br>10.41 | .150<br>3.81 | | 74.0 | A6, A18, D17 |
| AT224 | .150<br>3.81 | .150<br>3.81 | .150<br>3.81 | .050<br>1.27 | .030<br>.76 | .025<br>.64 | .028<br>.71 | .050<br>1.27 | .160<br>4.06 | .030<br>0.76 | | | | | | | | | .15 | A21, F17 |
| AV243 | 1.01<br>25.65 | 1.63<br>41.40 | 1.59<br>40.39 | .30<br>7.62 | 1.05<br>26.67 | .14<br>3.56 | .46<br>11.68 | .12<br>3.05 | .030<br>.76 | | | | | | | | | | 18 | A22, D17 |
| AW254 | 3.00<br>76.20 | 2.06<br>52.32 | 1.90<br>48.26 | .100<br>2.54 | 2.500<br>63.50 | 1.525<br>38.74 | .125<br>3.18 | 1.000<br>25.40 | .50<br>12.70 | 2.00<br>50.80 | | | | | | | | | 280 | A8, C2, D24 |
| AW256 | 4.50<br>114.30 | 2.25<br>57.15 | 1.69<br>42.93 | .125<br>3.18 | 4.000<br>101.60 | 1.625<br>41.28 | .125<br>3.18 | .890<br>22.61 | .44<br>11.18 | 3.50<br>88.90 | | | | | | | | | 500 | A8, C2, D24 |
| AW257 | 8.06<br>204.72 | 3.25<br>82.55 | 2.38<br>60.45 | .125<br>3.18 | 7.560<br>192.02 | 2.625<br>66.68 | .125<br>3.18 | .890<br>22.61 | .44<br>11.18 | 7.06<br>179.32 | | | | | | | | | 1240 | A8, C2, D24 |
| AX255 | 3.00<br>76.20 | 2.00<br>50.80 | 1.90<br>48.26 | .100<br>2.54 | 2.500<br>63.50 | 1.525<br>38.74 | .125<br>3.18 | .125<br>31.75 | .50<br>12.70 | ---<br>--- | | | | | | | | | 300 | A8, D24 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A8. Case material: aluminum alloy. Finish: case irridite, heat sink black anodize.
- A16. Case material: ceramic. Lead material: #42 alloy. Finish: tin plate.
- A17. Case material: CRS. Lead material: kovar. Finish: gold plate 50 micro inches.
- A18. Mounting bracket finish: irridite or clear anodize.
- A19. Case material plastic, G-10 base. Termination finish: solder plate
- A21. Open-style, ceramic base. Termination finish: solder plate over nickel.
- A22. Case material: aluminum alloy. Finish: nickel plate; heat sink: black anodize.
- A23. Case material: plastic. Lead finish: solder plate.
- A28. Case material: ceramic. Lead material: Kovar. Finish: Solder plate over nickel.

C. MARKING
- C2. Consecutive marking n = no. of way power splitter.
- C6. RF input lead (1) identified by diagonally cut lead. Orientation is also indicated by underline in marking.
- C7. Lead #1 is identified by diagonally cut lead, located near letter M in marking.

D. CONNECTORS
- D17. Connectors; Female SMA only.
- D24. Connectors: BNC female standard. Type N or SMA consult factory.

E. SPECIAL TOLERANCES
- E3. Lead width ±.005; lead thickness ±.002; cap diameter ±.005 inch.
- E4. All tolerances are ±.005 except where minimum or maximum limits are shown.
- E6. Lead width ±.005 inch.

F. PACKAGING
- F1-29. Tape and reel packaging available. See Tape & Reel packaging information for details. To order Tape & Reel version add -TR suffix to model

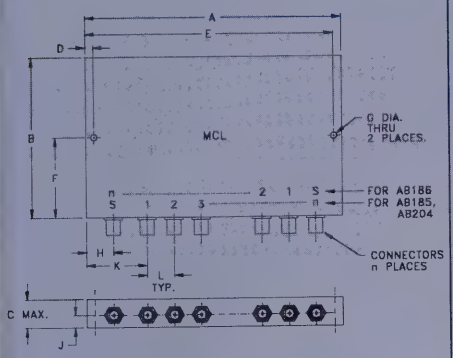


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

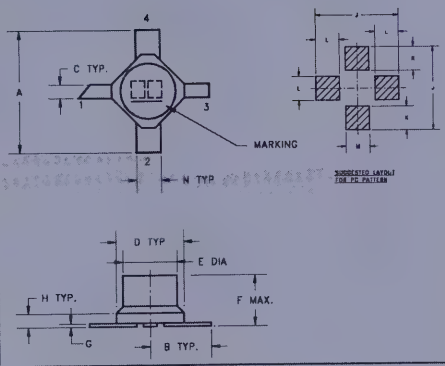
# outline drawings

Mini-Circuits®

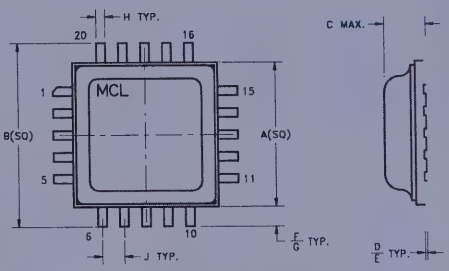
## AB



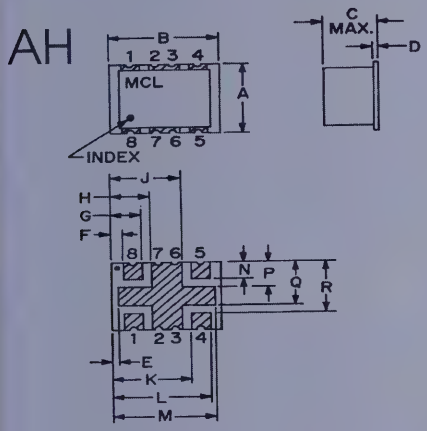

## AF



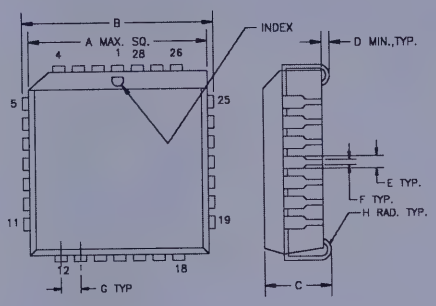

## AG



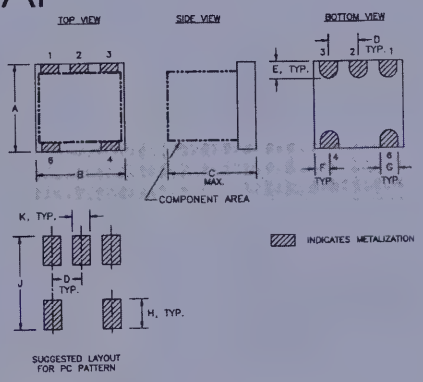

## AH



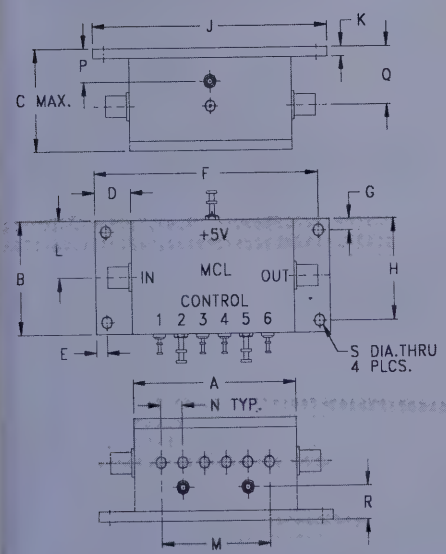

## AN



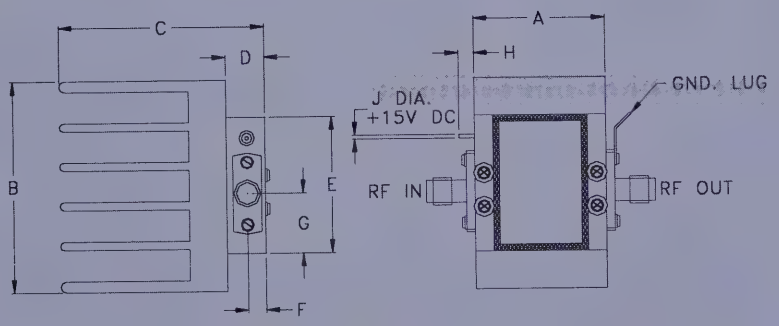

## AT



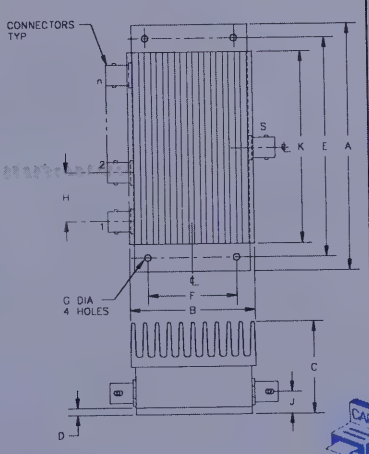

## AR



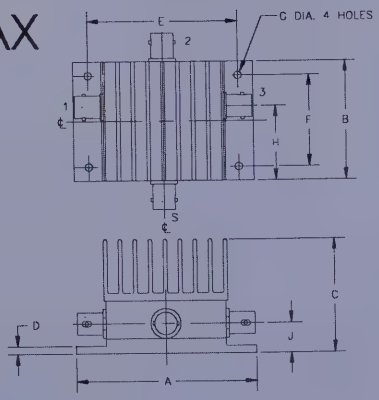

## AV




## AW




## AX




CAPO now available! computer-automated performance data

**In Stock... Immediate Delivery**

For Custom Versions Of Standard Models Consult Our Applications Dept.

# case styles
## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BB48 | .50<br>12.70 | .39<br>9.91 | .225<br>5.72 | .025<br>0.63 | .07<br>1.78 | .100<br>2.54 | .250<br>6.35 | .350<br>8.89 | .06<br>1.52 | .31<br>7.87 | | | | | | | | | 3.0 | A1, E1 |
| BG291 | .870<br>22.09 | .800<br>20.32 | —<br>— | .100<br>2.54 | .250<br>6.35 | .100<br>2.54 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .890<br>22.60 | | | | | | | | 4.0 | A27, F21 |
| BG419 | .870<br>22.09 | .800<br>20.32 | —<br>— | .100<br>2.54 | .400<br>10.16 | .100<br>2.54 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .890<br>22.60 | | | | | | | | 6.4 | A27 |
| BH292 | .280<br>7.11 | .310<br>7.87 | —<br>— | .100<br>2.54 | .225<br>5.71 | .055<br>1.39 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .060<br>1.52 | .300<br>7.62 | | | | | | | | .45 | A24, F24 |
| BJ293 | .395<br>10.10 | .500<br>12.70 | —<br>— | .100<br>2.54 | .230<br>5.84 | .100<br>2.54 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .060<br>1.52 | .425<br>10.41 | | | | | | | | .80 | A19, F23 |
| BJ398 | .305<br>7.75 | .390<br>9.91 | —<br>— | .100<br>2.54 | .100<br>2.54 | .045<br>1.14 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .325<br>8.26 | | | | | | | | .20 | A19, F29 |
| BK276 | .470<br>11.94 | .803<br>20.40 | —<br>— | .100<br>2.54 | .250<br>6.35 | .102<br>2.59 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .490<br>12.45 | | | | | | | | 3.0 | A27, F22 |
| BK343 | .460<br>11.68 | .768<br>19.51 | — | .100<br>2.54 | .155<br>3.94 | .084<br>2.13 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .480<br>12.19 | | | | | | | | 1.5 | A27, F27 |
| BK377 | .517<br>13.13 | .789<br>20.04 | —<br>— | .100<br>2.54 | .250<br>6.35 | .102<br>2.59 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .540<br>13.72 | | | | | | | | 3.0 | A27, F28 |
| BL301 | .940<br>23.88 | 1.260<br>32.00 | —<br>— | .100<br>2.54 | .390<br>9.91 | .080<br>2.59 | .100<br>2.54 | .047<br>1.19 | .065<br>1.65 | .065<br>1.65 | .970<br>24.64 | | | | | | | | 7.2 | A19, F2 |
| BN333 | 1.680<br>42.27 | 2.130<br>54.10 | 3.6<br>91.44 | 7.5<br>190.50 | .740<br>18.80 | .42<br>10.67 | 1.32<br>33.53 | .30<br>7.62 | .55<br>13.97 | .14<br>3.56 | | | | | | | | | 755 | A22, D17 |
| BR386 | 3.25<br>82.55 | 1.38<br>35.05 | 1.25<br>31.75 | .71<br>18.03 | 1.13<br>28.70 | .125<br>3.18 | 2.25<br>57.15 | .71<br>18.03 | .41<br>10.41 | .98<br>24.89 | 1.28<br>32.51 | 2.950<br>74.93 | .15<br>3.81 | 1.100<br>27.94 | .14<br>3.56 | .150<br>3.81 | | | 180 | A4,A18,D17 |
| BU413 | 1.00<br>25.40 | .75<br>19.05 | .58<br>14.73 | .50<br>12.70 | .29<br>7.37 | .38<br>9.65 | 1.40<br>3.56 | —<br>— | .687<br>17.45 | —<br>— | .32<br>8.13 | .13<br>3.30 | .10<br>2.54 | .16<br>4.06 | —<br>-- | —<br>-- | | | 25 | A4,C1,D6 |
| BV278 | 6.00<br>152.40 | 4.50<br>114.30 | 1.38<br>35.05 | .15<br>3.81 | 5.700<br>144.78 | .15<br>3.81 | 4.200<br>106.68 | .38<br>9.65 | 2.25<br>57.15 | .75<br>19.05 | .75<br>19.05 | .156<br>3.96 | | | | | | | 960 | A8,D16 |
| BW459 | 1.00<br>25.40 | .75<br>19.05 | .61<br>15.49 | .38<br>9.65 | .29<br>7.37 | .25<br>6.35 | .26<br>6.60 | .35<br>8.89 | .65<br>16.51 | .688<br>17.48 | .156<br>3.96 | .13<br>3.30 | 1.07<br>27.18 | .140<br>3.56 | | | | | 25 | A4,A18,D17 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch**

**oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C. R. S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541
- A8. Case material: aluminum alloy. Finish: case irridite. Heat sink black anodize.
- A18. Mounting bracket finish: irridite or clear anodize.
- A19. Case material: plastic, G-10 base. Termination finish: solder plate
- A22. Case material: aluminum alloy. finish: nickel plate. Heat sink: black anodize.
- A24. Case material: ceramic. Lead finish: tin plate
- A27 Header: Glass epoxy laminate. Cover: Cupro-nickel, bright-burnish Leads: Solder-plated iron-nickel alloy.

C. MARKING:
- C1. For port markings 1,2, and 3 see specification data sheet.

D. CONNECTORS
- D6. Connectors: female SMA only. Male SMA available on request, consult factory.
- D16. Connectors: please specify. Unless otherwise noted SMA is standard for ZHL-2-12; for all other models BNC is standard. TNC, N, SMA available on request, consult factory.
- D17. Connectors: Female SMA only.

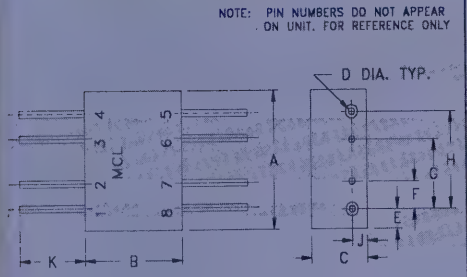
E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.

F. PACKAGING
- F1-29. Tape and reel packaging available. See Tape & Reel packaging information for details. To order Tape & Reel version add -TR suffix to model.

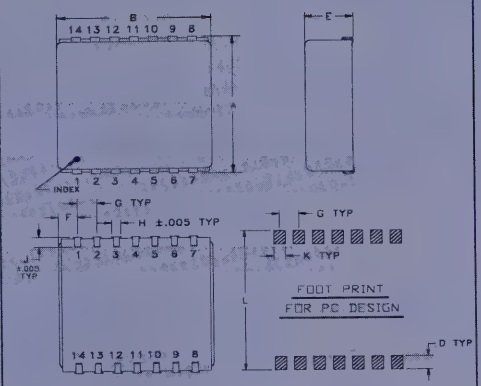


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

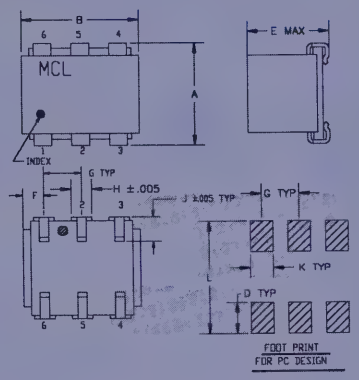
## BB



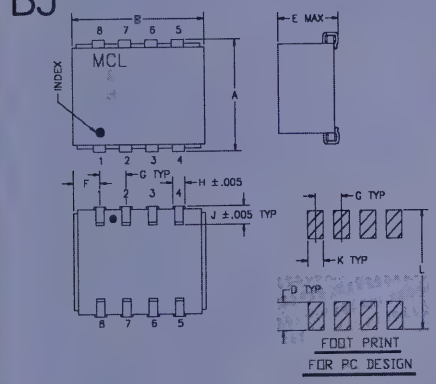

## BG



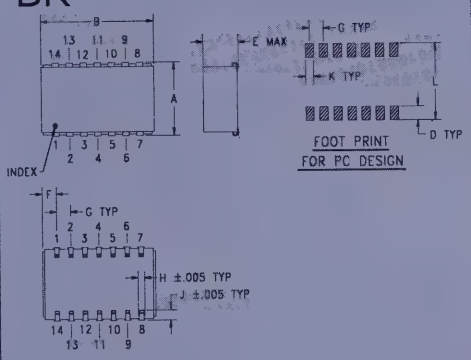

## BH



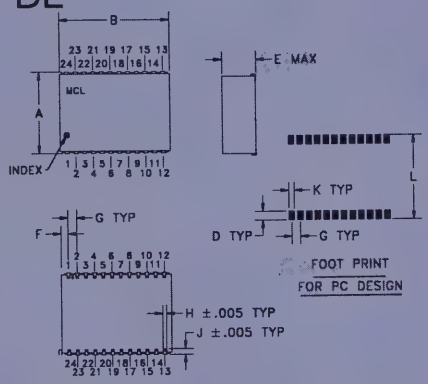

## BJ



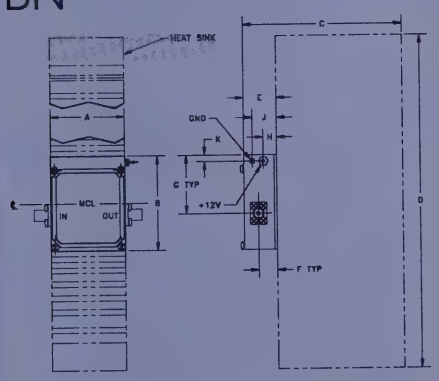

## BK



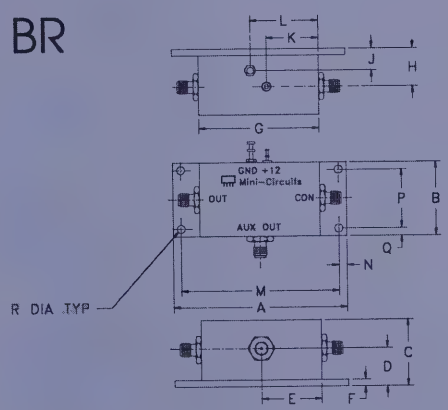

## BL



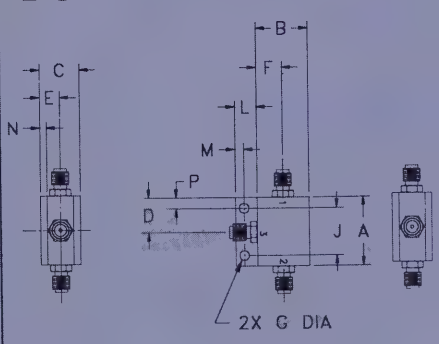

## BN



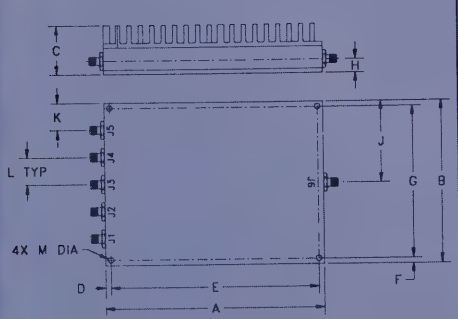

## BR



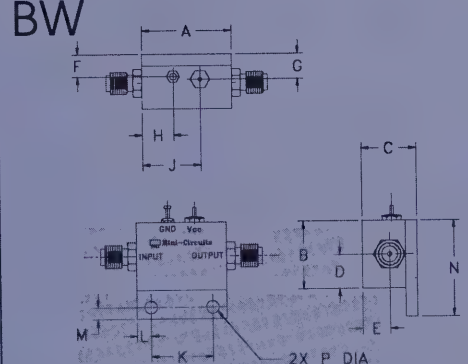

## BU




## BV




## BW




CAPO now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CC51 | 2.00<br>50.80 | 2.00<br>50.80 | .75<br>19.05 | .938<br>23.83 | .13<br>3.30 | 1.750<br>44.45 | .125<br>3.17 | .38<br>9.65 | 1.00<br>25.40 | 1.25<br>31.75 | | | | | | | | | 120.0 | A10, D11 |
| CC258 | 2.00<br>50.80 | 2.00<br>50.80 | .75<br>19.05 | .938<br>23.83 | .13<br>3.30 | 1.750<br>44.45 | .125<br>3.17 | .38<br>9.65 | 1.00<br>25.40 | 1.25<br>31.75 | | | | | | | | | 200.0 | A4, D24 |
| DD52 | 2.00<br>50.80 | 2.00<br>50.80 | .75<br>19.05 | .90<br>22.86 | .156<br>3.96 | 1.688<br>42.88 | .125<br>3.18 | .392<br>9.96 | 1.00<br>25.40 | .50<br>12.70 | 1.00<br>25.40 | 1.25<br>31.75 | | | | | | | 225.0 | A10, D11 |
| FF55 | 1.40<br>35.56 | .58<br>14.73 | .73<br>18.54 | 2.59<br>65.79 | —<br>— | | | | | | | | | | | | | | 40.0 | A9, D12 |
| FF56 | .98<br>24.89 | .43<br>10.92 | .47<br>11.94 | 1.70<br>43.18 | —<br>— | | | | | | | | | | | | | | 18.0 | A9, D13 |
| FF57 | 1.54<br>39.12 | .72<br>18.29 | .81<br>20.57 | 2.96<br>75.18 | .82<br>20.83 | | | | | | | | | | | | | | 90.0 | A9, D14 |
| FF58 | 1.40<br>35.56 | .58<br>14.73 | .61<br>15.49 | 2.59<br>65.79 | .64<br>16.26 | | | | | | | | | | | | | | 45.0 | A9, D15 |
| FF99 | 1.27<br>32.26 | .72<br>18.29 | .47<br>11.94 | 1.98<br>50.29 | | | | | | | | | | | | | | | 42.0 | A9, D13 |
| GG60 | 2.31<br>58.67 | 1.20<br>30.48 | .60<br>15.24 | .125<br>3.18 | 2.062<br>52.37 | .30<br>7.62 | .53<br>13.46 | .63<br>16.00 | | | | | | | | | | | 75.0 | A10, D10 |
| HH68 | 9.31<br>236.47 | 1.60<br>40.64 | 3.57<br>90.68 | 8.84<br>224.54 | .25<br>6.35 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .34<br>8.64 | .69<br>17.53 | .54<br>13.72 | .66<br>16.76 | 8.34<br>211.84 | .33<br>8.38 | .06<br>1.52 | | | | 1090.0 | A5, A18, D10 |
| JJ77 | 1.50<br>38.10 | 1.13<br>28.70 | .97<br>24.64 | .50<br>12.70 | .155<br>3.94 | 2.345<br>59.56 | .14<br>3.56 | .850<br>21.59 | 2.50<br>63.50 | .10<br>2.54 | .44<br>11.18 | .75<br>19.05 | .63<br>16.00 | .54<br>13.72 | .37<br>9.40 | .43<br>10.92 | .150<br>3.81 | .73<br>18.54 | 50.0 | A6, A11, A18, D17 |
| KK81 | .30<br>7.62 | .27<br>6.86 | .23<br>5.84 | .010<br>.25 | .042<br>1.07 | .020<br>.51 | .100<br>2.54 | .05<br>1.27 | .05<br>1.27 | .035<br>.89 | .036<br>.91 | .26<br>6.60 | .575<br>14.61 | | | | | | .50 | A3, E2, F1 |
| LL85 | 1.43<br>36.32 | .58<br>14.73 | .75<br>19.05 | | | | | | | | | | | | | | | | 21.5 | A9, D18 |
| LL86 | 1.19<br>30.23 | .58<br>14.73 | .51<br>12.95 | | | | | | | | | | | | | | | | 14.0 | A9, D19 |
| LL87 | 1.43<br>36.32 | .82<br>20.83 | .68<br>17.27 | | | | | | | | | | | | | | | | 48.5 | A9, D20 |
| LL88 | 1.43<br>36.32 | .61<br>15.49 | .75<br>19.05 | | | | | | | | | | | | | | | | 24.0 | A9, D21 |
| NN92 | 3.66<br>92.96 | 3.25<br>82.55 | 2.13<br>54.10 | .25<br>6.35 | 3.16<br>80.26 | .38<br>9.65 | 2.50<br>63.50 | .156<br>3.96 | .72<br>18.29 | .64<br>16.26 | .74<br>18.80 | 1.78<br>45.21 | 2.30<br>58.42 | .125<br>3.18 | .50<br>12.70 | 2.66<br>67.56 | | | 440.0 | A7, A8, A18, D6 |
| PP94 | .360<br>9.14 | .250<br>6.35 | .25<br>6.35 | .016<br>.41 | .020<br>.51 | .04<br>1.02 | .200<br>5.08 | | | | | | | | | | | | 1.5 | A26, C3 |
| PP120 | .50<br>12.70 | .21<br>5.33 | .150<br>3.81 | .016<br>.41 | .020<br>.51 | .04<br>1.02 | .300<br>7.62 | | | | | | | | | | | | 1.5 | A12, C3 |
| PP163 | .360<br>9.14 | .400<br>10.16 | .350<br>8.89 | .016<br>.41 | .020<br>.51 | .040<br>1.02 | .200<br>5.08 | | | | | | | | | | | | 2.9 | A12, C3 |
| PP230 | .50<br>12.70 | .250<br>6.35 | .240<br>6.10 | .016<br>.41 | .020<br>.51 | .04<br>1.02 | .300<br>7.62 | | | | | | | | | | | | 1.8 | A12, C3 |
| QQ95 | .500<br>12.70 | .250<br>6.35 | .25<br>6.35 | .016<br>.41 | .020<br>.51 | .04<br>1.02 | .300<br>7.62 | .150<br>3.81 | .150<br>3.81 | .075<br>1.91 | | | | | | | | | 3.5 | A12, C3 |
| QQ96 | .600<br>15.24 | .250<br>6.35 | .25<br>6.35 | .016<br>.41 | .020<br>.51 | .04<br>1.02 | .400<br>10.16 | .200<br>5.08 | .200<br>5.08 | .100<br>2.54 | | | | | | | | | 4.0 | A12, C3 |
| RR93 | 4.06<br>103.12 | 1.60<br>40.64 | 2.125<br>53.98 | 3.56<br>90.42 | .25<br>6.35 | .88<br>22.35 | .36<br>9.14 | .160<br>4.06 | .4<br>10.16 | .69<br>17.53 | .58<br>14.73 | .66<br>16.76 | 3.13<br>79.50 | .8<br>20.32 | .06<br>1.52 | .33<br>8.38 | | | 350.0 | A5, A10, A18, D9 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A3. Case material: epoxy. Pin material: iron-nickel alloy. Finish: bright tin-plate per MIL-T-10727.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A5. Case material: C.R.S. Finish: grey paint over hot-tin dip.
- A6. Case material: aluminum alloy. Finish: blue paint over iridite.
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate iridite per MIL-C-5541.
- A8. Case material: aluminum alloy. Finish: case iridite. Heat sink: black anodize.
- A9. Case material: brass. Finish: nickel plate.
- A10. Case material: aluminum alloy. Finish: grey paint or yellow iridite.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A12. Header and lead finish: gold plate per MIL-G-45204. Case material: Nickel
- A18. Mounting bracket finish: irridite or clear anodize.
- A26. Header material: C.R.S., pin material: #52 alloy; finish: electro tin, hot-oil flowed. Cover material: nickel.

C. MARKING
- C3. For Pin designations see specification data sheet.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D9. Connectors: BNC standard. TNC or Female SMA on request, consult factory.
- D10. Connectors: BNC standard. SMA on request, consult factory.
- D11. Connectors: Please specify; Type N or SMA.
- D12. Connectors: Male BNC, Female BNC standard. Other combinations with SMA available on request, consult factory.
- D13. Connectors: Male SMA. Female SMA only.
- D14. Connectors: Male N, Female N standard. Combinations with BNC, SMA, TNC available on request, consult factory.
- D15. Connectors: Male TNC. Female TNC only.
- D17. Connectors. Female SMA only.
- D18. Connectors: Male BNC only.
- D19. Connectors: Male SMA only.
- D20. Connectors: Male Type N only.
- D21. Connectors: Male TNC only.
- D24. Connectors: female BNC standard. Type N or SMA consult factory.

E. SPECIAL TOLERANCES
- E2. Lead width ±.010; lead thickness ±.005 inch.

F. PACKAGING
- F1-29. Tape and reel packaging available. See Tape and Reel Packaging information for details. To order Tape & Reel version add -TR suffix to model.

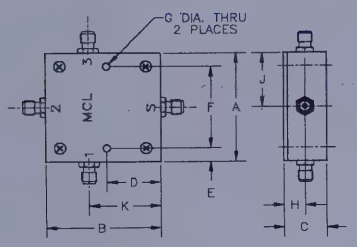


Mini-Circuits®
*INTERNET* http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
*Distribution Centers*/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

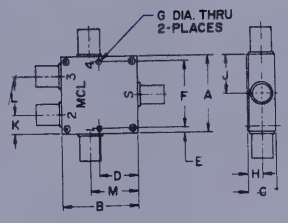
# outline drawings

Mini-Circuits

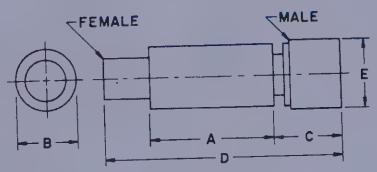
## CC



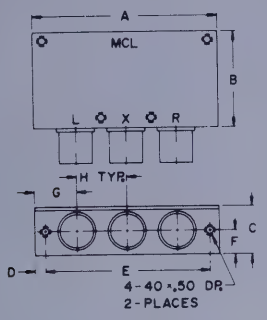

## DD



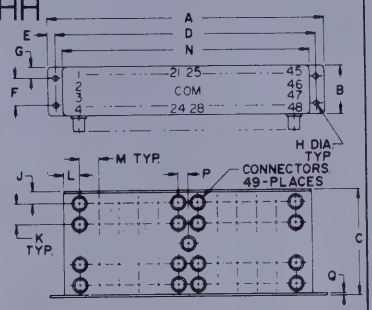

## FF



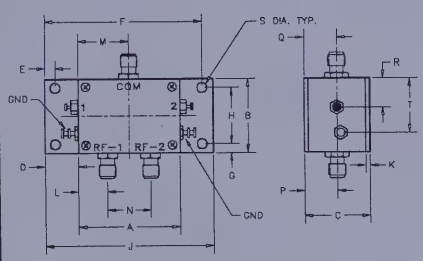

## GG




## HH

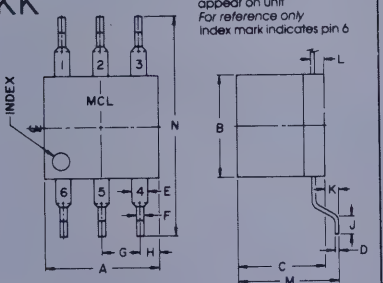



## JJ

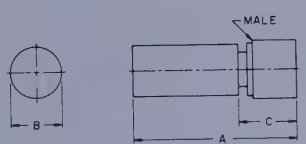



## KK

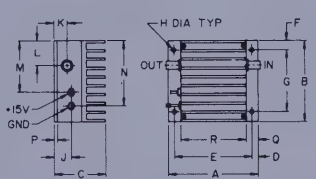
NOTE Pin numbers do not appear on unit
*For reference only*
Index mark indicates pin 6




## LL

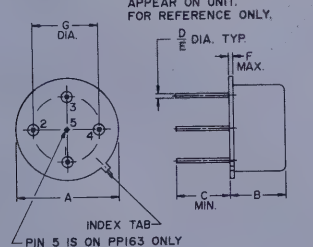



## NN



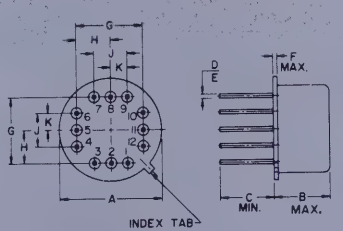

## PP

NOTE: PIN NUMBERS DO NOT APPEAR ON UNIT. FOR REFERENCE ONLY.

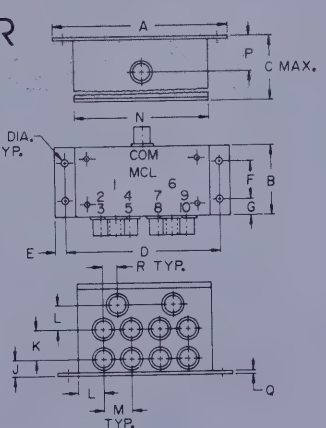



## QQ

NOTE Pin numbers do not appear on unit.
*For reference only*




## RR




**In Stock...Immediate Delivery**

For custom versions of standard models consult our applications dept.

now available! computer-automated performance data

# case styles
## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS98 | 1.25<br>31.75 | 1.56<br>39.62 | .75<br>19.05 | .63<br>16.00 | .39<br>9.91 | 1.56<br>39.62 | 1.000<br>25.40 | —<br>— | .125<br>3.18 | .46<br>11.68 | 2.18<br>55.37 | 1.688<br>42.88 | .07<br>1.78 | .750<br>19.05 | .50<br>12.70 | .80<br>20.32 | .45<br>11.43 | .29<br>7.37 | 85.0 | A8, A18, B1, D6 |
| TT100 | .250<br>6.35 | .310<br>7.87 | .20<br>5.08 | .100<br>2.54 | .050<br>1.27 | .055<br>1.40 | .040<br>1.02 | .070<br>1.78 | .270<br>6.86 | .050<br>1.27 | | | | | | | | | .50 | A14, F2 |
| TT146 | .250<br>6.35 | .310<br>7.87 | .275<br>6.99 | .100<br>2.54 | .050<br>1.27 | .055<br>1.40 | .040<br>1.02 | .070<br>1.78 | .270<br>6.86 | .050<br>1.27 | | | | | | | | | .50 | A14, F0 |
| TT240 | .250<br>6.35 | .310<br>7.87 | .20<br>5.08 | .100<br>2.54 | .050<br>1.27 | .055<br>1.40 | .040<br>1.02 | .070<br>1.78 | .270<br>6.86 | .050<br>1.27 | | | | | | | | | .50 | A20, F3 |
| TT241 | .250<br>6.35 | .310<br>7.87 | .275<br>6.99 | .100<br>2.54 | .050<br>1.27 | .055<br>1.40 | .040<br>1.02 | .070<br>1.78 | .270<br>6.86 | .050<br>1.27 | | | | | | | | | .50 | A20, F0 |
| UU102 | 3.50<br>88.90 | 2.00<br>50.80 | .50<br>12.70 | .150<br>3.81 | 3.350<br>85.09 | 1.00<br>25.40 | .125<br>3.18 | 1.75<br>44.45 | .20<br>5.08 | .55<br>13.97 | | | | | | | | | 120.0 | A10, C2, D17 |
| UU179 | 8.50<br>215.90 | 3.95<br>100.33 | .75<br>19.05 | .250<br>6.35 | 8.250<br>209.55 | —<br>— | .187<br>4.75 | 4.250<br>107.95 | .38<br>9.65 | .500<br>12.70 | .475<br>12.07 | 3.475<br>88.27 | | | | | | | 282 | A4, D17 |
| UU181 | 2.25<br>57.15 | 2.30<br>58.42 | .63<br>16.00 | .125<br>3.18 | 2.125<br>53.98 | —<br>— | .125<br>3.18 | 1.13<br>28.70 | .31<br>7.87 | .500<br>12.70 | .125<br>3.18 | 2.175<br>55.24 | | | | | | | 51 | A4, D17 |
| UU182 | 2.75<br>69.85 | 2.80<br>71.12 | .63<br>16.00 | .125<br>3.18 | 2.625<br>66.68 | —<br>— | .125<br>3.18 | 1.38<br>35.05 | .31<br>7.87 | .500<br>12.70 | .125<br>3.18 | 2.675<br>67.95 | | | | | | | 67 | A4, D17 |
| UU187 | 6.00<br>152.40 | 1.62<br>41.15 | .88<br>22.35 | .250<br>6.35 | 5.750<br>146.05 | .810<br>20.57 | .144<br>3.66 | 3.00<br>76.20 | .44<br>11.18 | 1.00<br>25.40 | —<br>— | —<br>— | | | | | | | 274 | A4, D23 |
| UU188 | 3.50<br>88.90 | 2.13<br>54.10 | .88<br>22.35 | .150<br>3.81 | 3.350<br>85.09 | 1.06<br>26.92 | .125<br>3.18 | 1.75<br>44.45 | .44<br>11.18 | .89<br>22.61 | —<br>— | —<br>— | | | | | | | 184 | A4, D23 |
| UU215 | 4.00<br>101.60 | 1.25<br>31.75 | .38<br>9.65 | .125<br>3.18 | 3.875<br>98.43 | .500<br>12.70 | #2-56<br>— | 2.00<br>50.80 | .19<br>4.83 | .500<br>12.70 | —<br>— | 1.125<br>28.58 | | | | | | | 77 | A4, D17 |
| UU233 | 1.50<br>38.10 | 1.00<br>25.40 | .38<br>9.65 | .125<br>3.18 | 1.375<br>34.93 | .500<br>12.70 | #2-56<br>— | .75<br>19.05 | .19<br>4.83 | .50<br>12.70 | | | | | | | | | 28.0 | A8, B8, C2, D17 |
| UU244 | 2.25<br>57.15 | 1.25<br>31.75 | .50<br>12.70 | .150<br>3.81 | 2.100<br>53.34 | .62<br>15.75 | .125<br>3.18 | 1.12<br>28.45 | .19<br>4.83 | .50<br>12.70 | | | | | | | | | 70 | A4, C2, D17 |
| UU449 | 9.78<br>248.41 | 3.13<br>79.50 | .88<br>22.35 | .200<br>5.08 | 9.580<br>243.33 | —<br>— | .144<br>3.66 | 4.89<br>124.21 | .44<br>11.18 | .89<br>22.61 | .200<br>5.08 | 2.930<br>74.42 | | | | | | | 840 | A4, D25 |
| VV105 | .085<br>2.16 | .060<br>1.52 | .008<br>.20 | .020<br>.51 | .256<br>6.50 | .012<br>.30 | .025<br>.64 | | | | | | | | | | | | .015 | A13, C4, E2 |
| WW107 | .020<br>.51 | .10<br>2.54 | .020<br>.51 | .092<br>2.34 | .085<br>2.16 | .060<br>1.52 | .008<br>.20 | .026<br>.66 | | | | | | | | | | | .015 | A13, C4, E2, F4 |
| XX112 | .18<br>4.57 | .18<br>4.57 | —<br>— | .40<br>10.16 | .36<br>9.14 | .050<br>1.27 | .015<br>.38 | .005<br>.13 | .005<br>.13 | .07<br>1.78 | .06<br>1.52 | | | | | | | | .15 | A15, E2, F19 |
| XX211 | .163<br>4.14 | .202<br>5.13 | .077<br>1.96 | .25<br>6.35 | .22<br>5.59 | .050<br>1.27 | .017<br>.43 | .009<br>.23 | .025<br>.63 | .03<br>.76 | —<br>— | | | | | | | | .10 | A13, E2, F16 |
| YY101 | .75<br>19.05 | .38<br>9.65 | .20<br>5.08 | .010<br>.25 | .050<br>1.27 | .020<br>.51 | .200<br>5.08 | .075<br>1.91 | .600<br>15.24 | .450<br>11.43 | .035<br>.89 | .47<br>11.94 | .100<br>2.54 | .150<br>3.81 | | | | | 1.6 | A13, E2, E5 F5 |
| YY109 | .75<br>19.05 | .38<br>9.65 | .20<br>5.08 | .010<br>.25 | .050<br>1.27 | .020<br>.51 | .200<br>5.08 | .075<br>1.91 | .600<br>15.24 | —<br>— | .16<br>4.06 | .72<br>18.29 | —<br>— | —<br>— | | | | | 1.6 | A13, E2, E5, F0 |
| YY161 | .75<br>19.05 | .38<br>9.65 | .28<br>7.11 | .010<br>.25 | .050<br>1.27 | .020<br>.51 | .200<br>5.08 | .075<br>1.91 | .600<br>15.24 | .450<br>11.43 | .035<br>.89 | .47<br>11.94 | .100<br>2.54 | .150<br>3.81 | | | | | 1.6 | A13, E2, F6 |
| ZZ121 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | .61<br>15.49 | —<br>— | .800<br>20.32 | .800<br>20.32 | .76<br>19.30 | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.37 | .75<br>19.05 | .07<br>1.78 | | | | 85.0 | A10, A18, B1, D6 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C.R.S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: iridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over iridite.
- A8. Case material: aluminum alloy. Finish: case iridite Heat sink, black anodize.
- A10. Case material: aluminum alloy. Finish: grey paint or yellow iridite.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A13. Case material: plastic. Lead finish: Tin or tin-lead plate.
- A14. Case material: ceramic or plastic, ceramic base. Terminations: palladium platinum silver.
- A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204 .
- A18. Mounting bracket finish: iridite or clear anodize.
- A20. Case material: ceramic. Terminations: solder plate over nickel. Board edges straight.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B7. Pin's meniscus (of header) 0.015" max.
- B8. #2-56 UNC-2B mounting holes provided to .32" deep minimum.

C. MARKING
- C2. Consecutive marking n = no. of way power splitter.
- C4. RF input lead (1) identified by diagonally cut lead; the cut may be 45°(ref) in either direction. It may also have an additional orientation mark. Model dash number identified by color dot or alphanumeric code on case. See specification data sheet.
- C5. RF output is identified by index mark, model dash number by alphanumeric code.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D17. Connectors: Female SMA only.
- D23. Connectors: Please specify female type N or SMA.
- D25. Connectors: Female N standard. For other connectors consult factory.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch.
- E5. For SCM mixers, long lead version (YY109) is available upon request; consult factory. To order short lead version (case YY101) add -NL suffix.

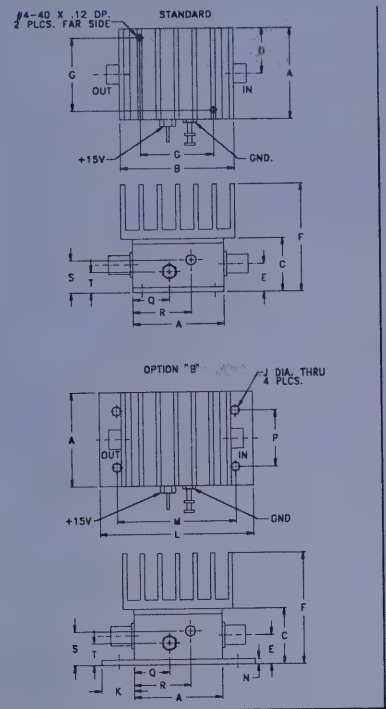
F. PACKAGING
- F0. Not available in Tape & Reel.
- F1-29. Tape and reel packaging available. See Tape and Reel Packaging information for details. To order Tape & Reel version add -TR suffix to model.



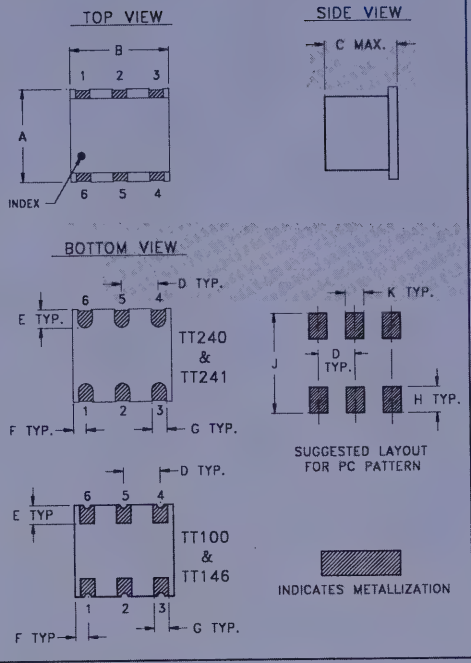
Mini-Circuits®
*INTERNET* http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
*Distribution Centers/* NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

Mini-Circuits

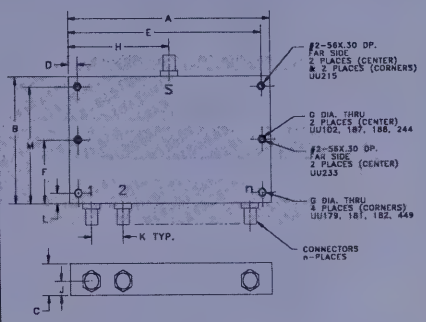
## SS



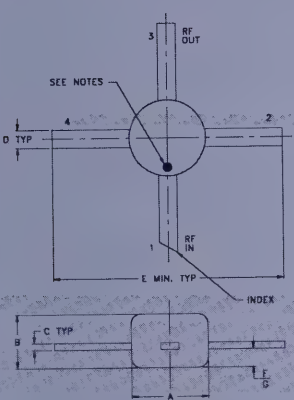

## TT



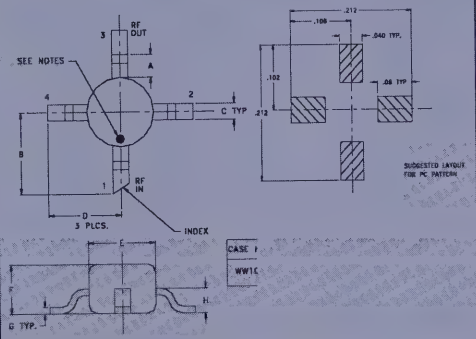

## UU



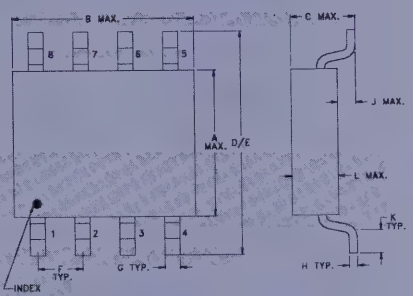

## VV



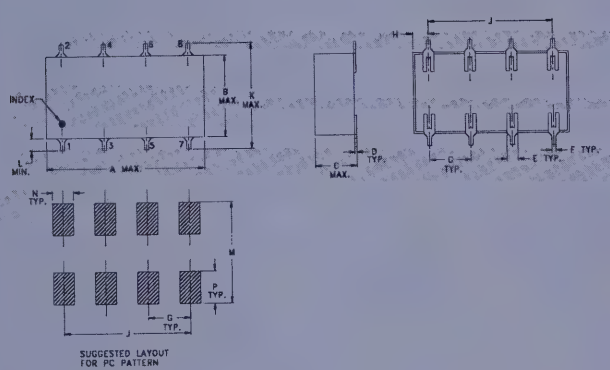

## WW



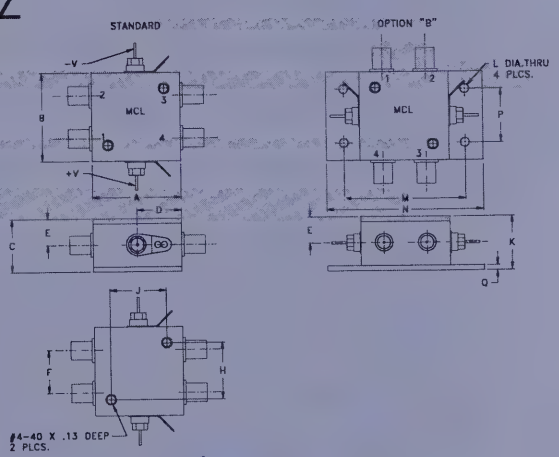

## XX




## YY




## ZZ




CAPS now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AAA118 | 1.50<br>38.10 | .50<br>12.70 | .935<br>23.75 | .040<br>1.02 | 1.100<br>27.94 | .19<br>4.83 | .400<br>10.16 | .15<br>3.81 | .600<br>15.24 | .300<br>7.62 | .20<br>5.08 | .14<br>3.56 | | | | | | | 19 | A1, E1, B7 |
| BBB123 | .145<br>3.69 | .100<br>2.54 | .04<br>1.02 | .006<br>.15 | .030<br>.76 | .488<br>12.40 | | | | | | | | | | | | | .015 | A13, C5, E2 |
| CCC127 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .12<br>3.05 | .80<br>20.32 | .69<br>17.53 | 1.60<br>40.64 | .60<br>15.24 | 1.200<br>30.48 | .52<br>13.21 | .82<br>20.83 | .150<br>3.81 | 80.0 | A6, A11, A18, D17 |
| DDD131 | 7.00<br>177.80 | 3.25<br>82.55 | 3.13<br>79.50 | .25<br>6.35 | 6.500<br>165.10 | .38<br>9.65 | 2.500<br>63.50 | .156<br>3.96 | .88<br>22.35 | .43<br>10.92 | .62<br>15.75 | 1.00<br>25.40 | 2.63<br>66.68 | .125<br>3.18 | .50<br>12.70 | 6.00<br>152.40 | 2.23<br>56.64 | 8.35<br>212.09 | 1884.0 | A7, A18, D6 |
| DDD338 | 7.00<br>177.80 | 3.25<br>82.55 | 3.13<br>79.50 | .25<br>6.35 | 6.500<br>165.10 | .38<br>9.65 | 2.500<br>63.50 | .156<br>3.96 | .88<br>22.35 | .73<br>18.54 | .62<br>15.75 | 1.13<br>28.70 | 2.23<br>56.64 | .125<br>3.18 | .50<br>12.70 | 6.00<br>152.40 | 2.23<br>56.64 | 8.35<br>212.09 | 1884.0 | A7, A18, D6 |
| EEE132 | .90<br>22.86 | .90<br>22.86 | .675<br>17.15 | .245<br>6.22 | .45<br>11.43 | 1.34<br>34.04 | .09<br>2.29 | 1.152<br>29.26 | .09<br>2.29 | .712<br>18.08 | .22<br>5.59 | .106<br>2.69 | .05<br>1.27 | | | | | | 50.0 | A4, A18, D6 |
| FFF122 | .83<br>21.08 | .83<br>21.08 | .18<br>4.57 | .10<br>2.54 | .100<br>2.54 | .600<br>15.24 | .95<br>24.13 | .017<br>.43 | .15<br>3.81 | | | | | | | | | | 5.0 | A15, E1 |
| GGG126 | 2.25<br>57.15 | 1.38<br>35.05 | 1.24<br>31.50 | .50<br>12.70 | .150<br>3.81 | 3.100<br>78.74 | .138<br>3.51 | 1.238<br>31.45 | 3.25<br>82.55 | .12<br>3.05 | .80<br>20.32 | .69<br>17.53 | —<br>— | .60<br>15.24 | 1.200<br>30.48 | .52<br>13.21 | .82<br>20.83 | .150<br>3.81 | 80.0 | A6, A11, A18, D17 |
| HHH141 | 2.00<br>50.80 | 2.00<br>50.80 | .95<br>24.13 | 1.062<br>26.98 | 0.125<br>3.18 | 1.75<br>44.45 | .125<br>3.18 | 0.575<br>14.60 | 1.00<br>25.40 | 1.35<br>34.29 | | | | | | | | | 200.0 | A10, C1, D6 |
| JJJ142 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | .32<br>8.13 | —<br>— | .80<br>20.32 | .80<br>20.32 | | | | | | | | | | 70.0 | A10, D17 |
| JJJ245 | .75<br>19.05 | 1.00<br>25.40 | .58<br>14.73 | .38<br>9.65 | .29<br>7.37 | .35<br>8.89 | | | | | | | | | | | | | 22.0 | A4, B9, D6 |
| KKK155 | .32<br>8.13 | .445<br>11.30 | .090<br>2.29 | .006<br>.152 | .012<br>.30 | .070<br>1.78 | .050<br>1.270 | .010<br>.254 | .015<br>.38 | .030<br>.762 | .050<br>1.270 | .050<br>1.270 | | | | | | | .40 | A13, F7 |
| MMM168 | .045<br>1.14 | .055<br>1.40 | .110<br>2.79 | .120<br>3.05 | .041<br>1.04 | .005<br>.13 | .083<br>2.11 | .104<br>2.64 | .070<br>1.78 | .080<br>2.03 | .018<br>.46 | .024<br>0.61 | .030<br>.76 | .036<br>0.91 | .015<br>.38 | .021<br>0.53 | .023<br>0.58 | .006<br>.15 | 1.0 | A13, F8 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch** **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material C.R.S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate irridite per MIL-C-5541.
- A10. Case material: aluminum alloy. Finish: grey paint or yellow iridite.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A12. Header finish: gold plate per MIL-G-45204. Case material: cupro-nickel.
- A13. Case material: plastic. Lead finish: Tin or tin-lead plate.
- A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204.
- A18. Mounting bracket finish: irridite or clear anodize.

B. MOUNTING
- B7. Pin's meniscus (of header) 0.015" max.
- B9. No mounting holes.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.
- C5. RF output is identified by index mark, model dash number by alphanumeric code.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D17. Connectors: Female SMA only.

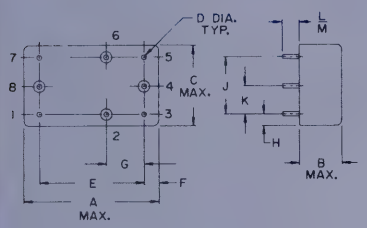
E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch

F. PACKAGING
- F1-29. Tape and reel packaging available. See Tape and Reel Packaging Information for details. To order Tape & Reel version add -TR suffix to model.

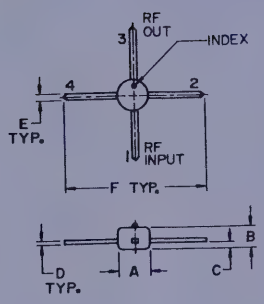
# outline drawings

Mini-Circuits

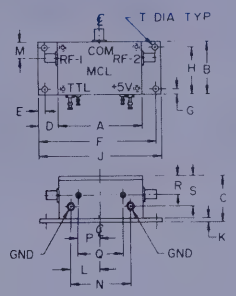
## AAA



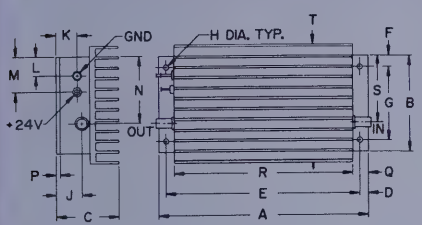

## BBB



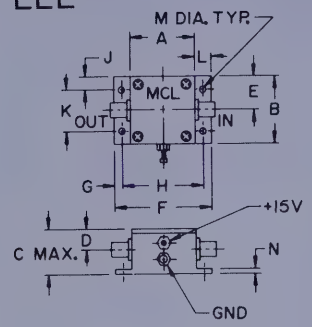

## CCC



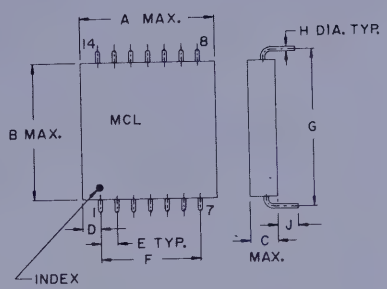

## DDD



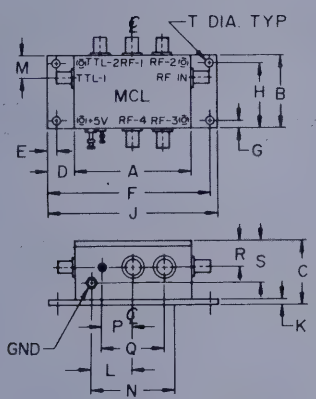

## EEE



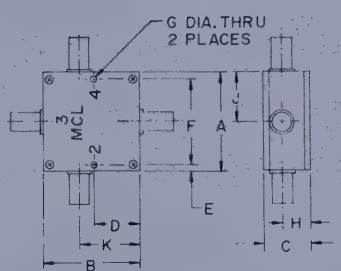

## FFF



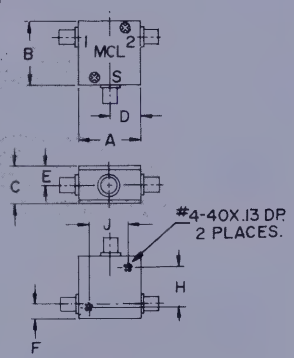

## GGG



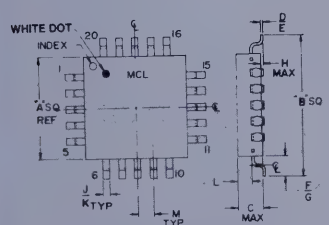

## HHH



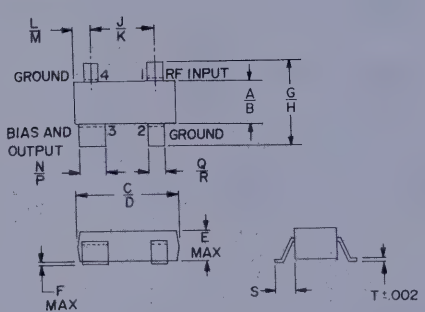

## JJJ




## KKK




## MMM




now available! computer-automated performance data

## In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

# case styles

## outline dimensions (inch / mm)

| case no. | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams. | NOTES* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NNN150 | 50<br>12.70 | .48<br>12.19 | .255<br>6.48 | .240<br>6.10 | .23<br>5.84 | .21<br>5.33 | .06<br>1.52 | .100<br>2.54 | .09<br>2.29 | .16<br>4.06 | .020<br>.51 | .09<br>2.29 | .005<br>.13 | | | | | | 1.9 | A1, E1, F9, B7 |
| PPP83 | .75<br>19.05 | .38<br>9.65 | .20<br>5.08 | .010<br>.25 | .05<br>1.27 | .020<br>.51 | .200<br>5.08 | .075<br>1.91 | .200<br>5.08 | .14<br>3.56 | .060<br>1.52 | | | | | | | | 1.6 | A13, E2 |
| QQQ130 | —<br>— | .310<br>7.87 | .20<br>5.08 | .10<br>2.54 | .010<br>.25 | .100<br>2.54 | .050<br>1.27 | .400<br>10.16 | .420<br>10.67 | .120<br>3.05 | .060<br>1.52 | .100<br>2.54 | .02<br>.51 | | | | | | .55 | A13, E2, F10 |
| RRR137 | .28<br>7.11 | .14<br>3.56 | .030<br>.76 | .020<br>.51 | .145<br>3.68 | .110<br>2.79 | .006<br>.15 | .010<br>.25 | .030<br>.76 | | | | | | | | | | .015 | A13, C5, E2, F11 |
| SSS173 | 1.25<br>31.75 | 1.25<br>31.75 | .75<br>19.05 | .63<br>16.00 | .38<br>9.65 | 1.000<br>25.40 | .125<br>3.18 | 1.000<br>25.40 | —<br>— | —<br>— | .125<br>3.18 | 1.688<br>42.88 | 2.18<br>55.38 | .75<br>19.05 | .07<br>1.78 | | | | 75 | A10, A18, D17 |
| TTT166 | .375<br>9.53 | .500<br>12.70 | .15<br>3.81 | .020<br>.51 | .075<br>1.91 | .250<br>6.35 | .425<br>10.80 | .187<br>4.75 | .050<br>1.27 | .050<br>1.27 | .070<br>1.78 | .270<br>6.86 | .540<br>13.72 | .060<br>1.52 | .095<br>2.41 | .445<br>11.30 | .208<br>5.28 | .415<br>10.54 | .8 | A19, F12 |
| TTT167 | .375<br>9.53 | .500<br>12.70 | .23<br>5.84 | .020<br>0.51 | .075<br>1.91 | .250<br>6.35 | .425<br>10.80 | .187<br>4.75 | .050<br>1.27 | .050<br>1.27 | .070<br>1.78 | .270<br>6.86 | .540<br>13.72 | .060<br>1.52 | .095<br>2.41 | .445<br>11.30 | .208<br>5.28 | .415<br>10.54 | .8 | A19, F13 |
| VVV180 | 1.80<br>45.72 | 1.75<br>44.45 | .50<br>12.70 | .125<br>3.18 | 1.675<br>42.55 | .125<br>3.18 | .125<br>3.18 | 1.625<br>41.28 | .23<br>5.84 | .63<br>16.00 | 1.13<br>28.70 | .88<br>22.35 | | | | | | | 34 | A4, D17 |

**tolerance .x±.1 .xx±.03 .xxx±.015 inch**

**oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH
- A1. Header material C.R.S Pin materal: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A10. Case material: aluminum alloy. Finish: grey paint or yellow iridite.
- A13. Case material: plastic. Lead finish: Tin or tin-lead plate.
- A18. Mounting bracket finish: irridite or clear anodize.
- A19. Case material plastic, G-10 base. Termination finish: solder plate

B. MOUNTING
- B7. Pin's meniscus (of header) 0.015" max.

C. MARKING
- C5. RF output is identified by index mark.

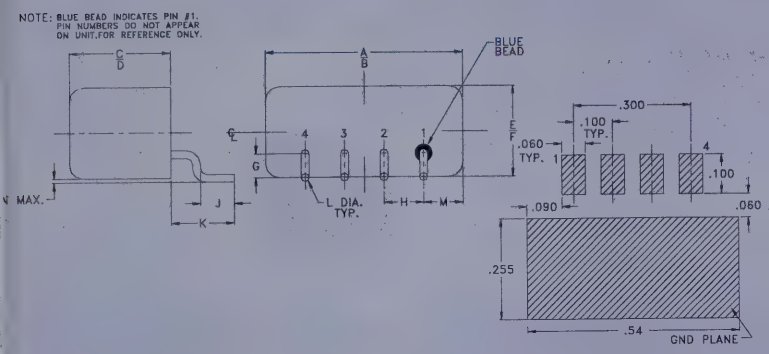
D. CONNECTORS
- D17. Connectors; Female SMA only.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch.

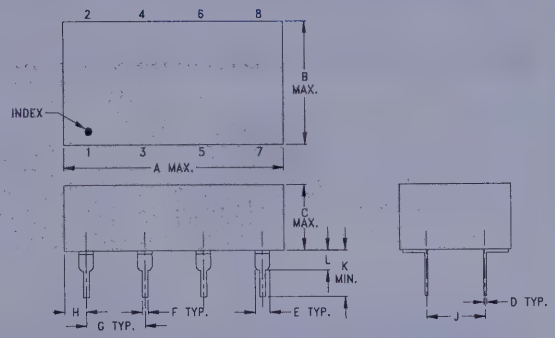
F. PACKAGING
- F1-29. Tape and reel packaging available. See Tape & Reel packaging information for details. To order Tape & Reel version add -TR suffix to model.

Mini-Circuits

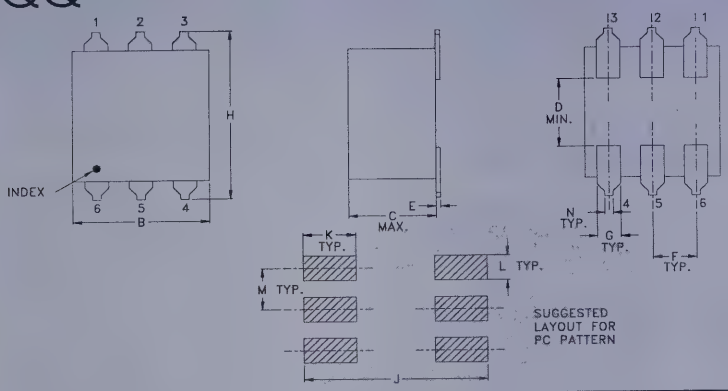
## NNN



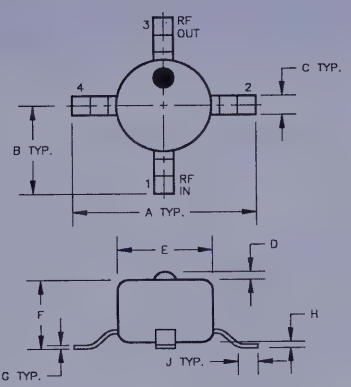

## PPP



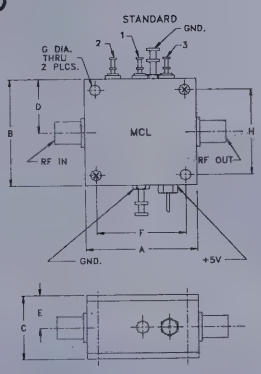

## QQQ



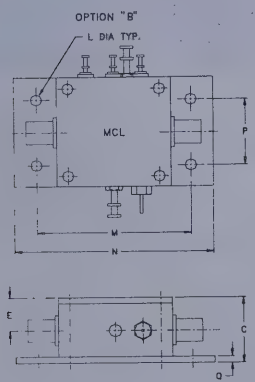

## RRR




## SSS

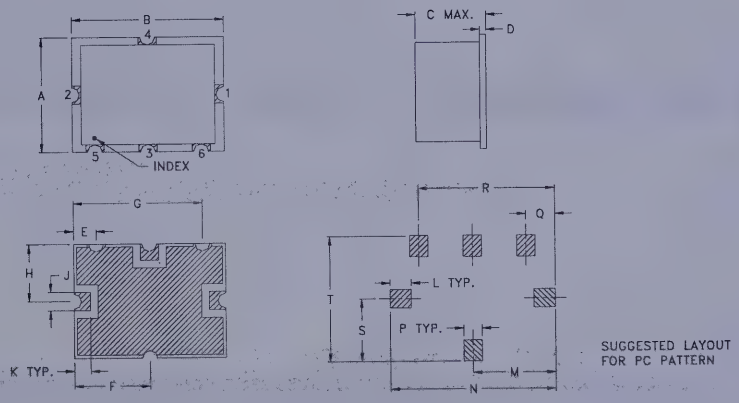




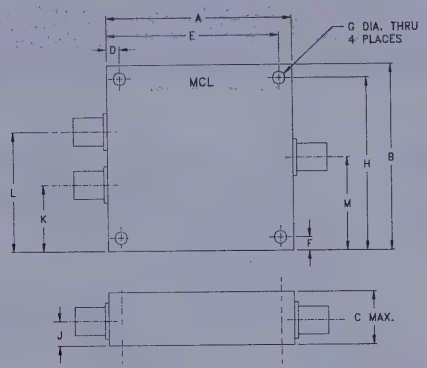






## TTT




## VVV

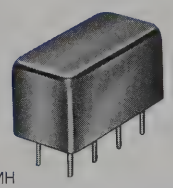



CAPO now available! computer-automated performance data

**In Stock...Immediate Delivery**

For custom versions of standard models consult our applications dept.

## ACTIVE, LOAD INSENSITIVE 10 to 500 MHz



UNCL-X
UNCL-X1MH

UNCL-X1 (+7 dBm LO, up to +1 dBm RF)
UNCL-X1MH (+13 dBm LO, up to +7 dBm RF)

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF $f_L$-$f_U$ | CONVERSION GAIN, dB Mid-Band m $\bar{x}$ | CONVERSION GAIN, dB Mid-Band m $\sigma$ | CONVERSION GAIN, dB Mid-Band m Min. | CONVERSION GAIN, dB Total Range Min. | LO-RF ISOLATION, dB L Typ. | LO-RF ISOLATION, dB L Min. | LO-RF ISOLATION, dB M Typ. | LO-RF ISOLATION, dB M Min. | LO-RF ISOLATION, dB U Typ. | LO-RF ISOLATION, dB U Min. | LO-IF ISOLATION, dB L Typ. | LO-IF ISOLATION, dB L Min. | LO-IF ISOLATION, dB M Typ. | LO-IF ISOLATION, dB M Min. | LO-IF ISOLATION, dB U Typ. | LO-IF ISOLATION, dB U Min. | INPUT POWER (dBm) 1 dB Comp Typ. | DC POWER Volt | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNCL-X1 | 1-500 | 10-500 | 1.57 | .05 | -1.0 | -1.0 | 60 | 40 | 30 | 25 | 25 | 20 | 50 | 30 | 30 | 20 | 26 | 18 | 1 | 12 | 36 | 1-280 | A01 | a | 23.95 |
| UNCL-X1MH | 1-500 | 10-500 | 2.41 | .015 | 0.5 | 0 | 60 | 40 | 35 | 25 | 30 | 20 | 50 | 30 | 25 | 18 | 18 | 14 | 7 | 12 | 60 | 1-276 | A01 | a | 27.95 |

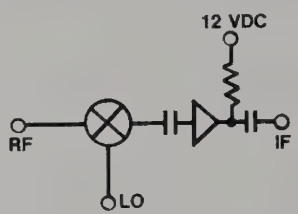
L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

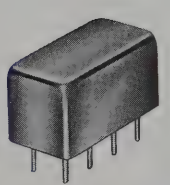
U = upper range ($f_U$/2 to $f_U$)

features

- 2-tone 3rd-order IM
- insensitive to IF load
- VSWR 1.2:1, IF/RF ports




## ACTIVE, LOW NOISE (4.3 dB typ.) 10 to 500 MHz



UNCL-R1
UNCL-R1H

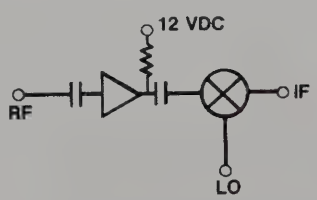
UNCL-R1 (+7 dBm LO, up to -10 dBm RF)
UNCL-R1H (+17 dBm LO, up to +1 dBm RF)

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF $f_L$-$f_U$ | CONVERSION GAIN, dB Mid-Band m $\bar{x}$ | CONVERSION GAIN, dB Mid-Band m $\sigma$ | CONVERSION GAIN, dB Mid-Band m Min. | CONVERSION GAIN, dB Total Range Typ. | CONVERSION GAIN, dB Total Range Min. | LO-RF ISOLATION, dB L Typ. | LO-RF ISOLATION, dB L Min. | LO-RF ISOLATION, dB M Typ. | LO-RF ISOLATION, dB M Min. | LO-RF ISOLATION, dB U Typ. | LO-RF ISOLATION, dB U Min. | LO-IF ISOLATION, dB L Typ. | LO-IF ISOLATION, dB L Min. | LO-IF ISOLATION, dB M Typ. | LO-IF ISOLATION, dB M Min. | LO-IF ISOLATION, dB U Typ. | LO-IF ISOLATION, dB U Min. | INPUT POWER (dBm) 1 dB Comp Typ. | DC POWER Volt | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNCL-R1 | 10-500 | DC-500 | 5.53 | .11 | 2 | 5 | 2 | 65 | 45 | 55 | 40 | 47 | 35 | 40 | 30 | 30 | 20 | 25 | 17 | -10 | 12 | 35 | 1-272 | A01 | b | 23.95 |
| UNCL-R1H | 10-500 | DC-500 | 6.32 | .23 | 3 | 6 | 2 | 65 | 45 | 55 | 40 | 47 | 35 | 40 | 30 | 35 | 25 | 28 | 19 | 1 | 12 | 60 | 1-274 | A01 | b | 27.95 |

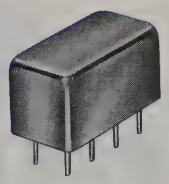
L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)



# ACTIVE, LOW LO DRIVE 10 to 500 MHz



UNCL - L1
UNCL-L1H

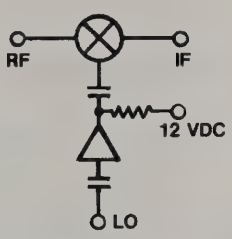
UNCL-L1 (-4 dBm LO, up to 1 dBm RF)
UNCL-L1H (+6 dBm LO, up to 14 dBm RF)

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS, dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | INPUT POWER (dBm) 1 dB Comp Typ. | DC POWER Volt | Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNCL-L1 | 10-500 | DC-500 | 5.73 | .08 | 8.0 | 8.5 | 45 | 30 | 35 | 20 | 25 | 17 | 32 | 20 | 23 | 15 | 18 | 12 | 1 | 12 | 35 | 1-278 | A01 | c | 23.95 |
| UNCL-L1H | 10-500 | DC-500 | 5.73 | .07 | 8.0 | 8.5 | 45 | 25 | 36 | 20 | 24 | 17 | 32 | 18 | 25 | 15 | 18 | 10 | 14 | 12 | 60 | 1-270 | A01 | c | 27.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)




**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| UNCL-X1MH | 5895-01-391-0040 |

NOTES:

$\bar{X}$ Average of conversion loss at center of mid-band frequency($f_L$ + $f_U$/4)
σ Standard deviation
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.

pin connections

| PORT | a | b | c |
|---|---|---|---|
| LO | 7 | 7 | 1 |
| RF | 8 | 1 | 7 |
| IF | 1 | 8 | 8 |
| DC | 4 | 4 | 4 |
| GND EXT. | 3,5,6 | 3,5,6 | 3,5,6 |
| CASE GND | 3,5,6 | 3,5,6 | 3,5,6 |
| NOT USED | 2 | 2 | 2 |

In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.

NEW!

# J-LEAD MIXERS UNPRECEDENTED IN VALUE.

## All Ceramic 2 to 1900MHz

$4.25 from (qty. 10-49)

JMS mixers mean unparalleled performance and reliability. Solder plated J leads provide improved reliability of the solder connection while significantly reducing thermal stress and leaching. All-welded internal construction withstands reflow temperatures up to 240°C for 5 minutes, and rugged construction enables JMS mixers to pass tough MIL-M-28837 shock and vibration tests. Additionally, the all-ceramic surface mount package has a cover pull strength of 20 pounds! Other quality features include 4.5 sigma repeatability unit-to unit, automated assembly for low-cost and fast, guaranteed 1 week shipment, tape and reel availability plus a 5 year Ultra-Rel™ guarantee. If value is a must...specify JMS mixers from Mini-Circuits.

***Mini-Circuits...we're redefining what VALUE is all about!***

**SPECIFICATIONS**

| MODEL | LO (dBm) | FREQUENCY (MHz) LO/RF | FREQUENCY (MHz) I F | MIDBAND (dB, typ.) Conv. Loss | Isolation L-R | Isolation L-I | $ea. (qty. 1-9) |
|---|---|---|---|---|---|---|---|
| JMS-1 | +7 | 2-500 | DC-500 | 5.75 | 45 | 45 | 4.95 |
| JMS-1LH | +10 | 2-500 | DC-500 | 5.75 | 55 | 45 | 8.45 |
| JMS-1MH | +13 | 2-500 | DC-500 | 5.75 | 60 | 45 | 9.45 |
| JMS-1H | +17 | 2-500 | DC-500 | 5.90 | 50 | 50 | 11.45 |
| JMS-2L | +3 | 800-1000 | DC-200 | 7.0 | 24 | 20 | 7.45 |
| JMS-2 | +7 | 20-1000 | DC-1000 | 7.0 | 50 | 47 | 7.45 |
| JMS-2LH | +10 | 20-1000 | DC-1000 | 6.5 | 48 | 35 | 9.45 |
| JMS-2MH | +13 | 20-1000 | DC-1000 | 7.0 | 50 | 47 | 10.45 |
| JMS-2H | +17 | 20-1000 | DC-1000 | 7.0 | 50 | 47 | 12.45 |
| JMS-2W | +7 | 5-1200 | DC-500 | 6.8 | 60 | 48 | 7.95 |
| JMS-11X | +7 | 5-1900 | 5-1000 | 6.7 | 35 | 37 | 4.25* |

Note: *10-49 qty.

Mini-Circuits®
P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718)332-4661

For detailed specs on all Mini-Circuits products refer to • THOMAS REGISTER • MICROWAVE PRODUCT DATA DIRECTORY • EEM • MINI-CIRCUITS' 740- pg. HANDBOOK

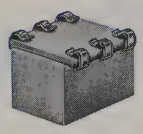
CUSTOM PRODUCT NEEDS...*Let Our Experience Work For You.*

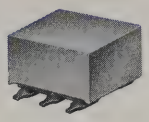
F 205 Rev Or

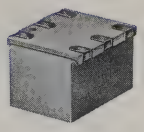
# FREQUENCY MIXERS

Surface Mount

## LEVEL 3 400 to 1400 MHz


JMS


LRMS


RMS

+3 dBm LO, up to -3 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS (dB) $\bar{x}$ | CONVERSION LOSS (dB) $\sigma$ | CONVERSION LOSS (dB) Max. | ISOLATION LO-RF (dB) Typ. | ISOLATION LO-RF (dB) Min. | ISOLATION LO-IF (dB) Typ. | ISOLATION LO-IF (dB) Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JMS-2L | 800-1000 | DC-200 | 7.0 | 0.2 | 8.4 | 24 | 17 | 20 | 14 | 1-210 | BH292 | ht | 7.45 |
| LRMS-2L | 800-1000 | DC-200 | 7.0 | 0.2 | 8.4 | 24 | 16 | 20 | 12 | 1-210 | QQQ130 | w | 6.95 |
| LRMS-5L | 400-1400 | DC-800 | 7.0 | 0.2 | 9.8 | 22 | 14 | 18 | 6 | 1-210 | QQQ130 | w | 13.95 |
| RMS-2L | 800-1000 | DC-200 | 7.0 | 0.2 | 8.4 | 24 | 16 | 20 | 12 | 1-210 | TT100 | w | 6.95 |
| RMS-5L | 400-1400 | DC-800 | 7.0 | 0.2 | 9.8 | 22 | 14 | 18 | 6 | 1-210 | TT100 | w | 13.95 |

### features

- low LO power: 3 dBm.
- JMS-2L, RMS-2L and LRMS-2L are usable at 0 dBm LO.
- wide band coverage: 400-1400 MHz.
- 1 dB compression, -3 dBm typical.
- miniature surface mount (0.25" x 0.31" x 0.2").
- conversion loss spec limit 4.5 s typical from mean.
- ideal for cellular applications.

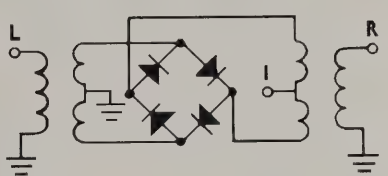
### pin connections

| PORT | w | ht[1] |
|---|---|---|
| LO | 1 | 6 |
| RF | 4 | 3 |
| IF | 5 | 2 |
| GND EXT. | 2,3,6 | 1,4,5 |
| CASE GND | — | — |
| NOT USED | — | — |

[1] pin connection physically same as w.

NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
$\sigma$ Standard deviation
A. Environmental specifications and re-flow soldering information available in General Information Section.
B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power, 50mW
1b. Peak IF current, 40mA

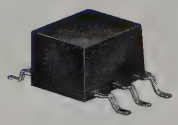


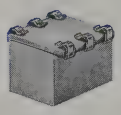

In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.
Available Tape & Reel

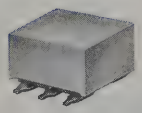
# FREQUENCY MIXERS

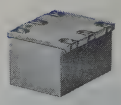
Surface Mount

## LEVEL 7 150 kHz to 3 GHz


ASK-KK81


†JMS


† LRMS


†RMS

### +7 dBm LO, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | m $\sigma$ | m Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ASK-1-KK81 | 1-600 | DC-600 | 5.58 | .06 | 7.0 | 8.5 | 50 | 30 | 35 | 25 | 30 | 20 | 45 | 35 | 30 | 20 | 25 | 15 | 1-76 | KK81 | w | 6.95 |
| ASK-2-KK81 | 1-1000 | DC-1000 | 6.79 | .10 | 8.0 | 9.8 | 60 | 40 | 35 | 18 | 26 | 16 | 50 | 30 | 25 | 17 | 15 | 10 | 1-248 | KK81 | w | 8.25 |
| JMS-1 | 2-500 | DC-500 | 5.75 | .10 | 7.0 | 8.0 | 55 | 50 | 45 | 30 | 40 | 25 | 55 | 45 | 45 | 25 | 32 | 20 | — | BH292 | ht | 4.95 |
| JMS-2 | 20-1000 | DC-1000 | 7.0 | .15 | 8.4 | 9.5 | 63 | 40 | 50 | 28 | 35 | 20 | 56 | 30 | 47 | 22 | 37 | 20 | — | BH292 | ht | 7.45 |
| JMS-2W | 5-1200 | DC-500 | 6.8 | .10 | 8.0 | 9.0 | 60 | 40 | 60 | 30 | 37 | 20 | 60 | 40 | 48 | 20 | 31 | 15 | — | BH292 | ht | 7.95 |
| NEW JMS-5 | 5-1500 | DC-1000 | 6.0 | .10 | 8.0 | 9.5 | 63 | 40 | 50 | 25 | 35 | 20 | 60 | 40 | 30 | 18 | 15 | 8 | — | BH292 | ht | 9.95 |
| JMS-11X | 5-1900 | 5-1000 | 6.7 | .15 | 8.2 | 9.8 | 58 | 45 | 35 | 20 | 27 | 18 | 56 | 45 | 37 | 20 | 27 | 20 | — | BH292 | hu | 4.25*** |
| LRMS-1 | 0.5-500 | DC-500 | 5.94 | .05 | 7.0 | 8.5 | 55 | 50 | 33 | 25 | 27 | 20 | 55 | 45 | 30 | 23 | 24 | 19 | 1-218 | QQQ130 | w | 6.25 |
| LRMS-1W | 2-750 | DC-750 | 5.83 | .21 | 7.5 | 8.5 | 70 | 45 | 45 | 28 | 38 | 22 | 60 | 45 | 40 | 25 | 30 | 20 | 1-282 | QQQ130 | w | 6.75 |
| LRMS-2 | 5-1000 | DC-1000 | 6.67 | .26 | 8.0 | 9.5 | 60 | 40 | 40 | 20 | 25 | 18 | 55 | 30 | 30 | 20 | 20 | 12 | 1-224 | QQQ130 | w | 6.95 |
| LRMS-2D | 5-1000 | DC-1000 | 6.81 | .06 | 8.0 | 10.0 | 59 | 40 | 40 | 30 | 33 | 22 | 55 | 30 | 40 | 22 | 30 | 20 | 1-284 | QQQ130 | w | 7.25 |
| LRMS-2U | 10-1000 | 10-750 | 6.79 | .16 | 8.0 | 9.5 | 55 | 40 | 40 | 30 | 30 | 25 | 55 | 30 | 35 | 25 | 30 | 22 | 1-230 | QQQ130 | w | 11.45 |
| LRMS-5 | 5-1500 | DC-1000 | 5.92 | .34 | 7.5 | 9.5 | 60 | 40 | 40 | 20 | 30 | 18 | 55 | 30 | 30 | 18 | 15 | 8 | 1-232 | QQQ130 | w | 13.95 |
| LRMS-11A | 1500-1900 | 40-400 | 7.44 | .36 | — | 9.0 | | | 25 (typ.) | | 17 (min.) | | | | 23 (typ.) | | 15 (min.) | | 1-212 | QQQ130 | w | 16.95 |
| LRMS-860 | 800-1050 | DC-250 | 5.5 | .23 | 7.5 | 7.5 | | | 36 (typ.) | | 25 (min.) | | | | 24 (typ.) | | 18 (min.) | | 1-286 | QQQ130 | w | 11.45 |
| RMS-1 | 0.5-500 | DC-500 | 5.94 | .05 | 7.0 | 8.5 | 55 | 50 | 33 | 25 | 27 | 20 | 55 | 45 | 30 | 23 | 24 | 19 | 1-218 | TT100 | w | 6.25 |
| RMS-1W | 2-750 | DC-750 | 5.83 | .21 | 7.5 | 8.5 | 70 | 45 | 45 | 28 | 38 | 22 | 60 | 45 | 40 | 25 | 30 | 20 | 1-282 | TT100 | w | 6.75 |
| RMS-1BM | 5-600 | DC-600 | 6.0 | .05 | 7.0 | 7.5 | 65 | 45 | 50 | 32 | 35 | 23 | 55 | 40 | 40 | 25 | 35 | 22 | — | TT100 | w | 6.25 |
| RMS-2 | 5-1000 | DC-1000 | 6.67 | .26 | 8.0 | 9.5 | 60 | 40 | 40 | 20 | 25 | 18 | 55 | 30 | 30 | 20 | 20 | 12 | 1-224 | TT100 | w | 6.95 |
| RMS-2D | 5-1000 | DC-1000 | 6.81 | .06 | 8.0 | 10.0 | 59 | 40 | 40 | 30 | 33 | 22 | 55 | 30 | 40 | 22 | 30 | 20 | 1-284 | TT100 | w | 7.25 |
| RMS-2U | 10-1000 | 10-750 | 6.79 | .16 | 8.0 | 9.5 | 55 | 40 | 40 | 30 | 30 | 25 | 55 | 30 | 35 | 25 | 30 | 22 | 1-230 | TT100 | w | 11.45 |
| RMS-5 | 5-1500 | DC-1000 | 5.92 | .34 | 7.5 | 9.5 | 60 | 40 | 40 | 20 | 30 | 18 | 55 | 30 | 30 | 18 | 15 | 8 | 1-232 | TT100 | w | 13.95 |
| RMS-11A | 1500-1900 | 40-400 | 7.44 | .36 | — | 9.0 | | | 25 (typ.) | | 17 (min.) | | | | 23 (typ.) | | 15 (min.) | | 1-212 | TT100 | w | 16.95 |
| ✪ RMS-11F | 350-2000 | DC-400 | 5.5 | .20 | 7.0 | 9.2 | 37 | 26 | 36 | 20 | 32 | 20 | 22 | 14 | 29 | 20 | 28 | 20 | — | TT240 | w | 4.95*** |
| RMS-11X | 5-1900 | 5-1000 | 7.1 | .10 | 8.2 | 9.8 | 58 | 45 | 35 | 20 | 27 | 18 | 56 | 45 | 37 | 20 | 27 | 20 | — | TT240 | gk | 3.95*** |
| RMS-30 | 200-3000 | DC-1000 | 6.5 | .20 | 9.0 | 9.8 | | | 27 (typ.) | | 17 (min.) | | | | 20 (typ.) | | 7 (min.) | | — | TT240 | w | 6.95*** |
| RMS-860 | 800-1050 | DC-250 | 5.5 | .23 | 7.5 | 7.5 | | | 36 (typ.) | | 25 (min.) | | | | 24 (typ.) | | 18 (min.) | | 1-286 | TT100 | w | 11.45 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

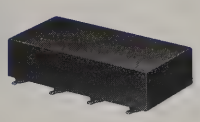
### pin connections see case style outline drawings for pin locations

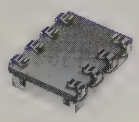
| PORT | d | k | r | w | x | z | gk | gm | ht[1] | hu[2] | hp | je |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 1 | 1 | 2 | 4 | 1 | 4 | 6 | 6 | 5 | 1 |
| RF | 1 | 1 | 8 | 4 | 1 | 1 | 5 | 2 | 3 | 2 | 1 | 5 |
| IF | 3,4^ | 3 | 3 | 5 | 3 | 2 | 4 | 1 | 2 | 3 | 7 | 7 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,4,5,6,7 | 2,3,6 | 4,5,6 | 3 | 2,3,6 | 3 | 1,4,5 | 1,4,5 | 2,3,4,6,8 | 2,3,4,6,8 |
| CASE GND | — | — | — | — | — | 3 | — | 3 | — | — | — | — |
| NOT USED | — | 4 | — | — | — | — | — | — | — | — | — | — |

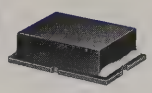
^ pins must be connected together externally
[1] pin connection physically same as w
[2] pin connection physically same as gk

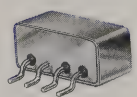


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


SCM


SKY


SYM


TUF-SM

## +7 dBm LO, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band $\bar{x}$ | m σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCM-1 | 1-500 | DC-500 | 5.72 | .10 | 7.0 | 8.0 | 60 | 40 | 45 | 35 | 40 | 30 | 50 | 40 | 45 | 35 | 40 | 25 | 1-236 | YY101 | d | 4.25 |
| SCM-2 | 5-1000 | DC-500 | 5.76 | .03 | 8.3 | 9.8 | 50 | 40 | 40 | 25 | 35 | 20 | 55 | 30 | 40 | 25 | 30 | 18 | 1-238 | YY101 | k | 5.45 |
| SCM-5 | 1250-1800 | DC-500 | 5.82 | .19 | — | 8.0 | 28 (typ.) | | 17 (min.) | | | | 18 (typ.) | | 8 (min.) | | | | 1-196 | YY101 | r | 11.95 |
| SCM-2500 | 500-2500 | DC-500 | 5.88 | .08 | 6.9 | 10.0 | 35 | 22 | 35 | 22 | 35 | 22 | 18 | 12 | 18 | 12 | 18 | 12 | 1-266 | YY101 | r | 11.95 |
| NEW SKY-5G | 2000-5000 | DC-1000 | 6.6 | .10 | — | 9.5 | 28 (typ.) | | 20 (min.) | | | | 13 (typ.) | | 7 (min.) | | | | — | BJ398 | je | 14.95 |
| NEW SKY-7G | 2000-7000 | DC-1000 | 7.0 | .10 | — | 9.8 | 28 (typ.) | | 15 (min.) | | | | 20 (typ.) | | 7 (min.) | | | | — | BJ398 | je | 16.95 |
| NEW SKY-53R | 2800-5300 | DC-500 | 5.7 | .20 | — | 9.5 | 28 (typ.) | | 15 (min.) | | | | 12 (typ.) | | 8 (min.) | | | | — | BJ398 | hp | 14.95 |
| NEW SKY-60 | 2500-6000 | DC-1500 | 6.2 | .20 | — | 9.7 | 28 (typ.) | | 17 (min.) | | | | 14 (typ.) | | 8 (min.) | | | | — | BJ398 | je | 14.95 |
| SYM-2 | 2-1000 | DC-1000 | 5.4 | .10 | 7.2 | 9.5 | 70 | 45 | 50 | 30 | 40 | 25 | 63 | 40 | 48 | 24 | 37 | 20 | 1-66 | TTT166 | x | 11.95 |
| SYM-860 | 800-1050 | DC-250 | 5.6 | .10 | 7.0 | 7.0 | 39 (typ.) | | 25 (min.) | | | | 37 (typ.) | | 20 (min.) | | | | 1-292 | TTT166 | x | 8.95 |
| SYM-11 | 1-2500 | 10-600 | 7.0 | .30 | 9.0 | 10.5 | 63 | 40 | 40 | 24 | 34 | 20 | 61 | 40 | 35 | 20 | 28 | 15 | 1-288 | TTT167 | x | 9.95 |
| SYM-12 | 5-1200 | DC-1000 | 6.5 | .30 | 8.0 | 9.0 | 68 | 45 | 50 | 30 | 37 | 25 | 56 | 40 | 46 | 25 | 29 | 18 | — | TTT167 | x | 9.45 |
| SYM-2500 | 1-2500 | DC-500 | 6.5 | .10 | 8.5 | 9.8 | 70 | 50 | 50 | 25 | 36 | 20 | 60 | 45 | 30 | 10 | 16 | 8 | — | TTT167 | x | 11.95 |
| TUF-1SM | 2-600 | DC-600 | 5.85 | .04 | 7.0 | 8.0 | 60 | 50 | 42 | 30 | 37 | 25 | 60 | 45 | 47 | 30 | 36 | 22 | 1-192 | NNN150 | z | 4.25 |
| TUF-2SM | 50-1000 | DC-1000 | 5.85 | .07 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 50 | 35 | 44 | 20 | 29 | 18 | 1-194 | NNN150 | z | 5.20 |
| † TUF-3SM | 0.15-400 | DC-400 | 4.7 | .02 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 47 | 25 | 35 | 20 | 1-200 | NNN150 | z | 6.10 |
| TUF-5SM | 20-1500 | DC-1000 | 5.7 | .04 | 9.0 | 9.0 | 54 | 40 | 42 | 30 | 39 | 25 | 40 | 25 | 32 | 18 | 23 | 8 | 1-206 | NNN150 | z | 9.45 |
| TUF-5XSM | 1-1500 | 1-1000 | 5.9 | .10 | 7.0 | 9.0 | 60 | 40 | 40 | 20 | 28 | 17 | 60 | 45 | 45 | 25 | 38 | 20 | — | NNN150 | gm | 11.95 |
| TUF-11ASM | 1400-1900 | 40-500 | 6.8 | .30 | 8.6 | 8.6 | 33 (typ.) | | 20 (min.) | | | | 29 (typ.) | | 15 (min.) | | | | 1-290 | NNN150 | z | 16.95 |
| TUF-860SM | 800-1050 | DC-250 | 5.6 | .24 | 7.75 | 7.75 | 35 (typ.) | | 25 (min.) | | | | 27 (typ.) | | 20 (min.) | | | | 1-292 | NNN150 | z | 9.45 |

L = low range ($f_L$ to 10 $f_L$)

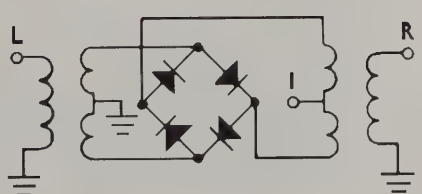
M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

NOTES:
- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
- σ Standard deviation
- † Phase detection, positive polarity except RMS-860 and LRMS-860
- ✪ Frequency ranges specified: m = 350-1000 MHz, L = 350-750 MHz, M = 750-1000 MHz, U = 1000-2000 MHz
- * Price for quantities 10-49
- A. Environmental specifications and re-flow soldering information available in General Information Section.
- B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. RF power, 50mW
  - 1b. Peak IF current, 40mA

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| RMS-1 | 5895-01-415-6798 |
| RMS-2TR | 5895-01-382-2092 |
| SCM-1NL | 5895-01-374-9561 |



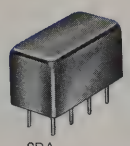

In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.

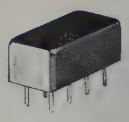
# FREQUENCY MIXERS

Plug-In

## LEVEL 7 500 Hz to 3.5 GHz

GRA


SRA


SBL
SIMA

### +7 dBm LO, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band $\bar{x}$ | m σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRA-1 | 5-500 | DC-500 | 5.96 | .09 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-92 | D09 | y | 14.95 |
| GRA-3 | .025-200 | DC-200 | 4.78 | .07 | 7.5 | 8.5 | 60 | 50 | 45 | 35 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-46 | D09 | y | 18.45 |
| GRA-6 | .003-100 | DC-100 | 4.70 | .14 | 7.5 | 8.5 | 60 | 50 | 45 | 30 | 35 | 25 | 60 | 45 | 40 | 25 | 30 | 20 | 1-48 | D09 | y | 28.95 |
| GRA-8 | .0005-10 | DC-10 | 6.03 | .08 | 7.5 | 8.5 | 60 | 50 | 50 | 40 | 45 | 35 | 60 | 50 | 50 | 40 | 45 | 35 | 1-50 | D09 | y | 31.95 |
| SRA-1 | .5-500 | DC-500 | 5.11 | .09 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-92 | A01 | e | 13.45 |
| SRA-1TX | .5-500 | DC-500 | 5.68 | .04 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-92 | A01 | e | 59.95 |
| SRA-1W | 1-750 | DC-750 | 5.80 | .04 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-54 | A01 | f | 15.95 |
| SRA-1-1 | .1-500 | DC-500 | 4.81 | .11 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-52 | A01 | e | 14.95 |
| SRA-2 | 1-1000 | .5-500 | 5.66 | .07 | 7.5 | 8.5 | 45 | 30 | 35 | 20 | 30 | 20 | 45 | 30 | 30 | 20 | 30 | 20 | 1-56 | A01 | j | 15.95 |
| SRA-2CM | 5-1000 | DC-1000 | 5.27 | .04 | 7.0 | 8.5 | 60 | 50 | 35 | 30 | 30 | 25 | 50 | 45 | 30 | 25 | 25 | 20 | 1-96 | A01 | f | 14.95 |
| SRA-3 | .025-200 | DC-200 | 4.61 | .06 | 7.5 | 8.5 | 60 | 50 | 45 | 35 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-46 | A01 | e | 15.95 |
| SRA-4 | 5-1250 | .5-500 | 5.71 | .08 | 7.5 | 8.5 | 50 | 40 | 40 | 20 | 30 | 20 | 50 | 40 | 40 | 20 | 30 | 20 | 1-122 | A01 | j | 17.95 |
| SRA-5 | 5-1500 | 10-600 | 6.69 | .07 | 8.0 | 8.5 | 50 | 45 | 35 | 30 | 30 | 20 | 45 | 40 | 30 | 25 | 25 | 15 | 1-20 | A06 | m | 24.95 |
| SRA-6 | .003-100 | DC-100 | 4.58 | .05 | 7.5 | 8.5 | 60 | 50 | 45 | 30 | 35 | 25 | 60 | 45 | 40 | 25 | 30 | 20 | 1-48 | A01 | d | 24.95 |
| SRA-8 | .0005-10 | DC-10 | 5.69 | .11 | 7.5 | 8.5 | 60 | 50 | 50 | 40 | 45 | 35 | 60 | 50 | 50 | 40 | 45 | 35 | 1-50 | A01 | d | 29.95 |
| SRA-11 | 5-2000 | 10-600 | 6.72 | .07 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 30 | 20 | 45 | 40 | 30 | 20 | 25 | 15 | 1-58 | A06 | m | 20.95 |
| SRA-12 | 800-1250 | 50-90 | 6.21 | .13 | 7.5 | 7.5 | 32 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-74 | A06 | m | 29.95 |
| SRA-149*** | 5-500 | DC-500 | 5.61 | .07 | 6.5 | 8.0 | 60 | 50 | 55 | 45 | 53 | 40 | 50 | 40 | 35 | 25 | 30 | 24 | 1-240 | A06 | p | 9.95 |
| SRA-2000 | 100-2000 | DC-600 | 8.60 | .15 | 9.5 | 9.5 | 37 (Typ.) 20 (Min.) | | | | | | 30 (Typ.) 20 (Min.) | | | | | | 1-60 | A06 | m | 21.95 |
| SRA-2400 | 750-2400 | DC-400 | 5.95 | .26 | 9.0 | 9.0 | 30 | 20 | 30 | 20 | 30 | 20 | 30 | 8 | 30 | 8 | 30 | 8 | 1-266 | A06 | s | 22.95 |
| SRA-3500** | 500-3500 | DC-1000 | 7.28 | .31 | 9.5 | 9.5 | 30 | 17 | 30 | 17 | 30 | 17 | 20 | 8 | 20 | 8 | 20 | 8 | 1-244 | A06 | s | 28.95 |
| ❑ SBL-1 | 1-500 | DC-500 | 5.60 | .09 | 7.0 | 8.0 | 60 | 45 | 45 | 35 | 40 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-62 | A06 | d | 4.75 |
| ❑ SBL-1X | 10-1000 | 5-500 | 5.88 | .10 | 7.5 | 8.0 | 50 | 40 | 40 | 30 | 30 | 20 | 50 | 45 | 40 | 35 | 35 | 25 | 1-64 | A06 | j | 6.45 |
| ❑ SBL-1Z | 10-1000 | DC-500 | 6.27 | .09 | 7.5 | 9.0 | 50 | 40 | 35 | 25 | 25 | 20 | 40 | 25 | 25 | 18 | 19 | 15 | 1-114 | A06 | s | 7.45 |
| ❑ SBL-1-1 | 0.1-400 | DC-400 | 4.84 | .04 | 7.0 | 8.0 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-116 | A06 | d | 7.45 |
| ❑ SBL-3 | .025-200 | DC-200 | 4.81 | .05 | 7.5 | 8.5 | 55 | 50 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-118 | A06 | e | 7.45 |
| ❑ SBL-11 | 5-2000 | 10-600 | 7.08 | .11 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 30 | 20 | 45 | 40 | 30 | 20 | 25 | 15 | 1-58 | A06 | m | 19.95 |
| SIMA-5 | 2-1500 | DC-1000 | 7.01 | .08 | 8.0 | 9.0 | 65 | 44 | 44 | 23 | 31 | 22 | 54 | 38 | 30 | 18 | 25 | 11 | 1-198 | A06 | n | 24.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
- σ Standard deviation
- ❑ Non-hermetic
- † Phase detection, positive polarity
- * Conversion loss 9.5 dB maximum from 0.01 to 0.015 MHz
- ** Conversion loss 10dB maximum at IF=1000 MHz
- *** Blue bead pin 4
- ✻ Conversion Loss max is 3 dB higher for IF freq. range 0.5 to 5 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. RF power, 50 mW
  - 1b. Peak IF current, 40 mA

### NSN GUIDE

| MCL NO. | NSN MIL-M-28837/1* |
|---|---|
| GRA-1 | 5895-00-480-2849 |
| GRA-3 | 5895-01-169-1815 |
| GRA-8 | 5895-01-217-5627 |
| SAM-1 | 5895-01-117-2926 |
| SAM-2 | 5895-01-165-6621 |
| SAM-3 | 5895-01-062-9973 |
| SAM-5 | 5895-01-036-9507 |
| SBL-1 | 5895-01-126-4913 |
| SBL-1X | 5895-01-179-8084 |
| SRA-1 | 5895-00-008-8272 03 |
| SRA-1-1 | 5962-01-113-5431 |
| SRA-1-TX | 5895-01-163-9247 |
| SRA-1-1-TX | 5895-01-151-6753 |
| SRA-11-TX | 5895-01-163-9248 |
| SRA-1W | 5895-01-163-0433 09 |
| SRA-3 | 5895-01-021-5914 |
| SRA-4 | 5826-01-155-6545 |
| SRA-6 | 5895-01-124-0117 |
| SRA-8 | 5985-01-081-0977 |
| SRA-11 | 5895-01-273-0883 |
| SBL-3 | 5895-01-326-6030 |
| TAK-5 | 5895-01-271-0842 |
| TAK-6 | 5895-01-231-2372 |
| TSM-1 | 5895-01-121-7958 |
| TSM-3 | 5895-01-373-2444 |

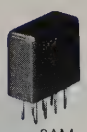
*units are not QPL listed



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

TAK

TSM


SAM

ROSE

## +7 dBm LO, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | m σ | m Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TAK-5* | .01-250 | DC-250 | 4.65 | .02 | 7.0 | 8.5 | 60 | 50 | 50 | 35 | 40 | 35 | 55 | 45 | 45 | 30 | 35 | 25 | 1-86 | A04 | e | 20.95 |
| TAK-5R | .05-200 | DC-200 | 4.70 | .05 | 6.5 | 8.0 | 55 | 50 | 45 | 35 | 45 | 35 | 50 | 45 | 40 | 30 | 40 | 30 | 1-88 | A04 | d | 20.95 |
| TAK-6 | .5-600 | DC-600 | 5.58 | .04 | 7.5 | 8.5 | 60 | 50 | 50 | 30 | 40 | 25 | 55 | 45 | 45 | 30 | 30 | 20 | 1-90 | A04 | e | 20.95 |
| TAK-6R | .5-600 | DC-600 | 5.40 | .11 | 7.0 | 8.0 | 55 | 50 | 45 | 30 | 35 | 30 | 45 | 40 | 40 | 25 | 30 | 25 | 1-90 | A04 | t | 20.95 |
| TAK-7 | 2-1000 | 5-500 | 5.86 | .08 | 7.5 | 8.5 | 45 | 30 | 35 | 20 | 30 | 20 | 45 | 30 | 35 | 20 | 30 | 20 | 1-56 | A04 | j | 20.95 |
| TSM-1 | 1-600 | DC-600 | 5.71 | .04 | 7.5 | 8.5 | 60 | 45 | 45 | 35 | 35 | 25 | 55 | 45 | 40 | 30 | 35 | 25 | 1-102 | A11 | e | 19.95 |
| TSM-2 | 1-1000 | DC-1000 | 5.55 | .08 | 7.5 | 10.0 | 55 | 45 | 40 | 20 | 35 | 18 | 50 | 40 | 40 | 20 | 25 | 18 | 1-66 | A11 | f | 20.95 |
| TSM-3 | .1-500 | DC-500 | 4.75 | .04 | 7.5 | 8.5 | 60 | 50 | 50 | 35 | 35 | 25 | 55 | 45 | 45 | 30 | 35 | 25 | 1-106 | A11 | e | 21.95 |
| † TSM-5 | 5-1500 | DC-1000 | 6.16 | .04 | 8.5 | 9.5 | 60 | 45 | 35 | 25 | 30 | 25 | 60 | 45 | 35 | 25 | 25 | 16 | 1-268 | A11 | e | 27.95 |
| SAM-1 | 1-600 | DC-600 | 5.67 | .05 | 7.0 | 8.5 | 55 | 45 | 45 | 30 | 35 | 20 | 50 | 40 | 40 | 25 | 30 | 20 | 1-102 | A03 | e | 16.95 |
| SAM-2 | 1-1000 | DC-1000 | 5.68 | .08 | 7.5 | 9.5 | 55 | 45 | 40 | 25 | 35 | 20 | 50 | 40 | 40 | 25 | 30 | 25 | 1-66 | A03 | f | 20.45 |
| SAM-3 | 0.1-500 | DC-500 | 5.04 | .07 | 7.0 | 8.5 | 60 | 50 | 50 | 35 | 35 | 30 | 50 | 40 | 45 | 30 | 30 | 20 | 1-106 | A03 | e | 19.95 |
| SAM-4 | 5-1250 | 0.5-1000 | 5.98 | .18 | 8.5 | 8.5 | 55 | 40 | 35 | 25 | 30 | 20 | 50 | 40 | 35 | 25 | 30 | 20 | 1-108 | A03 | j | 23.95 |
| SAM-5 | 5-1500 | 0.5-1000 | 5.81 | .08 | 7.5 | ✳8.5 | 55 | 40 | 35 | 25 | 30 | 20 | 50 | 40 | 35 | 25 | 30 | 20 | 1-110 | A03 | j | 29.95 |
| ROSE-1 | 1-600 | DC-600 | 5.08 | .03 | 6.5 | 7.5 | 40 | 30 | 35 | 25 | 30 | 20 | 55 | 40 | 40 | 20 | 25 | 18 | 1-100 | PP94 | ab | 11.95 |
| ROSE-2 | 1-1000 | DC-1000 | 5.60 | .23 | 7.0 | 8.0 | 61 | 45 | 37 | 22 | 25 | 18 | 55 | 40 | 26 | 17 | 16 | 12 | — | PP94 | ab | 16.95 |

L = low range ($f_L$ to 10 $f_L$)

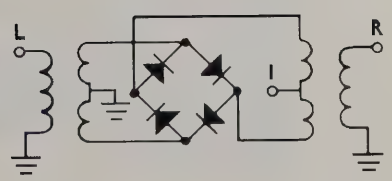
M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

## pin connections see case style outline drawings

| PORT | d | e | f | j | m | n | p | s | t | y | ab |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 1 | 1 | 1 | 1 |
| RF | 1 | 1 | 1 | 3,4^ | 1 | 1 | 2 | 8 | 8 | 6 | 3 |
| IF | 3,4^ | 3,4^ | 3,4^ | 1 | 3 | 3 | 5,6^ | 3 | 5,6^ | 4 | 2 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,4,5,6,7 | 1,3,4,7 | 2,5,6,7 | 2,3,4,7 | 2,3,5 | 4 |
| CASE GND | — | 2 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 3,4,7 | 2,5,6,7 | 3,4,7 | — | 4 |
| NOT USED | — | — | — | — | 4 | — | — | 4 | — | — | — |

^ pins must be connected together externally




CAPD now available! computer-automated performance data

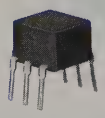
## In Stock... Immediate Delivery

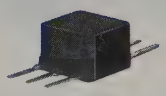
For Custom Versions Of Standard Models Consult Our Applications Dept.

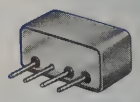
# FREQUENCY MIXERS

Plug-In & Flatpack

## LEVEL 7 40 kHz to 4.3 GHz


ASK-X65


ASK-W38


TFM

### +7 dBm Lo, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ❑ ASK-1* | 1-600 | DC-600 | 5.58 | .06 | 7.0 | 8.5 | 50 | 30 | 35 | 25 | 30 | 20 | 45 | 35 | 30 | 20 | 25 | 15 | 1-76 | W38 | w | 6.95 |
| ❑ ASK-2* | 1-1000 | DC-1000 | 6.79 | .10 | 8.0 | 9.8 | 60 | 40 | 35 | 18 | 26 | 16 | 50 | 30 | 25 | 17 | 15 | 10 | 1-248 | W38 | w | 8.25 |
| TFM-2 | 1-1000 | DC-1000 | 5.74 | .07 | 7.5 | 8.5 | 50 | 45 | 40 | 25 | 30 | 25 | 45 | 40 | 35 | 25 | 25 | 18 | 1-66 | B02 | z | 13.95 |
| † TFM-2P | 1-1000 | DC-1000 | 5.74 | .07 | 7.5 | 8.5 | 50 | 45 | 40 | 25 | 30 | 25 | 45 | 40 | 35 | 25 | 25 | 18 | 1-66 | B02 | z | 13.95 |
| † TFM-3** | 0.04-400 | DC-400 | 4.70 | .06 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 35 | 25 | 55 | 40 | 45 | 30 | 35 | 25 | 1-68 | B02 | z | 21.45 |
| † TFM-4 | 5-1250 | DC-1250 | 6.47 | .05 | 7.5 | 8.5 | 50 | 45 | 40 | 30 | 30 | 25 | 45 | 40 | 35 | 25 | 25 | 20 | 1-70 | B02 | z | 23.45 |
| TFM-5 | 5-1500 | DC-1000 | 6.33 | .06 | 8.5 | 9.5 | 60 | 45 | 35 | 25 | 30 | 25 | 60 | 40 | 35 | 15 | 25 | 14 | 1-268 | B02 | aa | 25.45 |
| TFM-11 | 1-2000 | 5-600 | 7.16 | .07 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 25 | 20 | 45 | 40 | 27 | 20 | 25 | 20 | 1-72 | B13 | z | 47.45 |
| TFM-12 | 800-1250 | 50-90 | 5.71 | .14 | — | 7.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-74 | B13 | z | 47.45 |
| TFM-2400 | 750-2400 | DC-400 | 6.65 | .20 | — | 9.0 | 30 | 20 | 30 | 20 | 30 | 20 | 30 | 10 | 30 | 10 | 30 | 10 | 1-266 | B13 | aa | 28.95 |
| TFM-4300 | 300-4300 | DC-800 | 5.87 | .13 | — | 10.5 | 30 | 20 | — | — | 30 | 17 | 15 | 7 | — | — | 10 | 7 | 1-246 | B13 | aa | 38.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

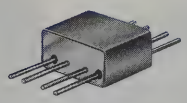
U = upper range ($f_U$/2 to $f_U$)

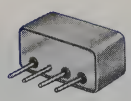
NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
σ Standard deviation
❑ Non-hermetic
† Phase detection, positive polarity.
* ASK plug-in mounting case X65
** Below 10°C, $f_L$ is 0.2 MHz.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0)
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power, 50mW
1b. Peak IF current, 40mA



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


LMX


TUF

## +7 dBm Lo, up to +1 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band m x | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LMX-3 | 0.04-400 | DC-400 | 4.84 | .05 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 35 | 25 | 45 | 40 | 35 | 25 | 25 | 20 | 1-68 | BB48 | q | 25.95 |
| LMX-113 | 5-1000 | DC-1000 | 5.72 | .05 | 7.0 | 8.0 | 50 | 40 | 40 | 25 | 35 | 25 | 45 | 35 | 35 | 30 | 30 | 20 | 1-78 | BB48 | q | 16.95 |
| LMX-124 | 0.5-500 | DC-500 | 5.18 | .06 | 6.5 | 7.0 | 50 | 40 | 45 | 25 | 45 | 22 | 45 | 40 | 40 | 30 | 30 | 20 | 1-80 | BB48 | q | 27.95 |
| LMX-149 | 10-1500 | DC-1500 | 6.58 | .09 | 7.5 | 9.0 | 55 | 40 | 45 | 35 | 30 | 20 | 50 | 40 | 40 | 25 | 20 | 12 | 1-82 | BB48 | q | 29.95 |
| LMX-156 | 800-2500 | DC-1500 | 7.09 | .37 | 9.0 | 9.0 | 35 | 25 | 35 | 25 | 35 | 25 | 22 | 17 | 22 | 17 | 22 | 17 | 1-214 | BB48 | q | 44.95 |
| ❑ TUF-1 | 2-600 | DC-600 | 5.85 | .04 | 7.0 | 8.0 | 60 | 50 | 42 | 30 | 37 | 25 | 60 | 45 | 47 | 30 | 36 | 22 | 1-192 | B02 | z | 4.25 |
| ❑ TUF-2 | 50-1000 | DC-1000 | 5.85 | .07 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 50 | 35 | 44 | 20 | 29 | 18 | 1-194 | B02 | z | 5.20 |
| ❑ TUF-3 | 0.15-400 | DC-400 | 4.7 | .02 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 47 | 25 | 35 | 20 | 1-200 | B02 | z | 6.10 |
| ❑ TUF-5 | 20-1500 | DC-1000 | 5.7 | .04 | 9.0 | 9.0 | 54 | 40 | 42 | 30 | 39 | 25 | 40 | 25 | 32 | 18 | 23 | 8 | 1-206 | B02 | z | 9.45 |
| ❑ TUF-5X | 1-1500 | 1-1000 | 5.9 | .10 | 7.0 | 9.0 | 60 | 40 | 40 | 20 | 28 | 17 | 60 | 45 | 45 | 25 | 38 | 20 | — | B02 | gm | 11.95 |
| ❑ TUF-11A | 1400-1900 | 40-500 | 6.8 | .30 | 8.6 | 8.6 | | | 33 (typ.) | | 20 (min.) | | | | 29 (typ.) | | 15 (min.) | | 1-290 | B02 | z | 16.95 |
| ❑ TUF-860 | 800-1050 | DC-250 | 5.6 | .24 | 7.75 | 7.75 | | | 35 (typ.) | | 25 (min.) | | | | 27 (typ.) | | 20 (min.) | | 1-292 | B02 | z | 9.45 |

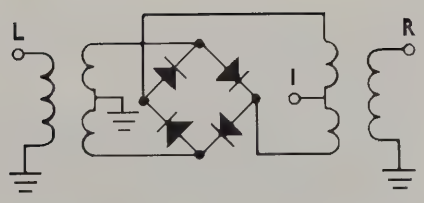
L = low range ($f_L$ to 10 $f_L$)  M = mid range (10 $f_L$ to $f_U$/2)  U = upper range ($f_U$/2 to $f_U$)
m = mid band (2$f_L$ to $f_U$/2)

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| ASK-1 | 5895-01-320-0366 |
| TFM-2 | 5895-01-135-1852 |
| TFM-3 | 5895-01-112-0031 |
| TFM-4 | 5895-01-317-9388 |
| TFM-11 | 5895-01-409-1158 |
| TFM-12 | 5895-01-179-5686 |

## pin connections see case style outline drawings

| PORT | q | w | z | aa | gm |
|---|---|---|---|---|---|
| LO | 8 | 1 | 4 | 1 | 4 |
| RF | 5 | 4 | 1 | 4 | 2 |
| IF | 4 | 5 | 2 | 2 | 1 |
| GND EXT. | 1,2,3,6,7 | 2,3,6 | 3 | 3 | 3 |
| CASE GND | 1,2,3,6,7 | — | 3 | 3 | 3 |
| NOT USED | — | — | — | — | — |




CAPD now available! computer-automated performance data

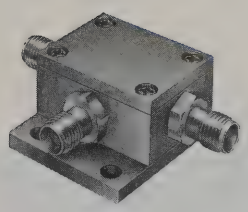
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

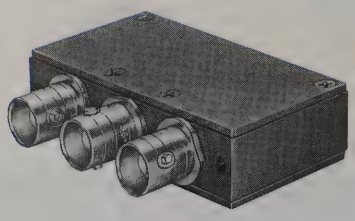
# FREQUENCY MIXERS

Coaxial

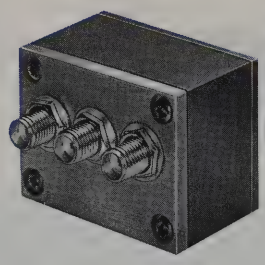
## LEVEL 7 500 Hz to 10 GHz



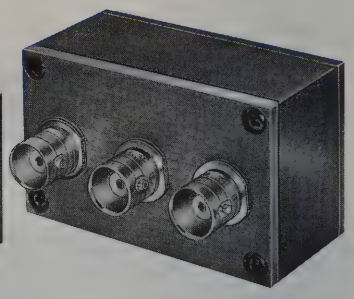
ZMX



ZP



ZLW



ZAD

### +7 dBm LO, up to +1 dBm RF

| | MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band $\bar{x}$ | Mid-Band m σ | Mid-Band Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | ZMX-7GR | 3700-7000 | DC-1000 | 5.0 | .30 | -- | 8.2 | | | 30 (typ.) | | 20 (min.) | | | | 36 (typ.) | | 20 (min.) | | -- | BU413 | af | 71.95 |
| NEW | ZMX-10G | 3700-10000 | DC-2000 | 5.0 | .10 | -- | 8.5 | | | 37 (typ.) | | 20 (min.)* | | | | 17 (typ.) | | 8 (min.) | | -- | BU413 | ad | 81.95 |
| | ZP-1 | 2-600 | DC-600 | 5.85 | .10 | 7.0 | 8.0 | 60 | 50 | 42 | 30 | 37 | 25 | 60 | 45 | 47 | 30 | 36 | 22 | 1-192 | GG60 | ag | 39.95 |
| | ZP-2 | 50-1000 | DC-1000 | 5.85 | .10 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 50 | 35 | 44 | 20 | 29 | 18 | 1-194 | GG60 | ag | 39.95 |
| † | ZP-3 | 0.15-400 | DC-400 | 4.7 | .10 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 47 | 25 | 35 | 20 | 1-200 | GG60 | ag | 39.95 |
| | ZP-5 | 20-1500 | DC-1000 | 5.7 | .10 | 9.0 | 9.0 | 54 | 40 | 42 | 30 | 39 | 25 | 40 | 25 | 32 | 18 | 23 | 8 | 1-206 | GG60 | ag | 47.95 |
| | ZP-5X | 1-1500 | 1-1000 | 5.9 | .10 | 7.0 | 9.0 | 60 | 40 | 40 | 20 | 28 | 17 | 60 | 45 | 45 | 25 | 38 | 20 | — | GG60 | hg | 47.95 |
| | ZP-11A | 1400-1900 | 40-500 | 6.8 | .30 | 8.6 | 8.6 | | | 33 (typ.) | | 20 (min.) | | | | 29 (typ.) | | 15 (min.) | | 1-290 | GG60 | ag | 47.95 |
| | ZP-860 | 800-1050 | DC-250 | 5.6 | .24 | 7.75 | 7.75 | | | 35 (typ.) | | 25 (min.) | | | | 27 (typ.) | | 20 (min.) | | 1-292 | GG60 | ag | 47.95 |
| | ZP10514 | .2-500 | DC-500 | 5.18 | .10 | 7.0 | 8.5 | 55 | 45 | 50 | 35 | 35 | 30 | 50 | 40 | 36 | 30 | 30 | 20 | 1-124 | GG60 | ag | 62.95 |
| △ | ZLW-1 | .5-500 | DC-500 | 5.81 | .08 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-92 | M21 | ae | 51.95 |
| △ | ZLW-1W | 1-750 | DC-750 | 5.74 | .05 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-54 | M21 | ae | 56.95 |
| △ | ZLW-1-1 | .1-500 | DC-500 | 4.82 | .07 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-52 | M21 | ae | 53.95 |
| △ | ZLW-2 | 1-1000 | DC-1000 | 5.68 | .08 | 7.5 | 9.5 | 55 | 45 | 40 | 25 | 35 | 20 | 50 | 40 | 40 | 25 | 30 | 20 | 1-66 | M21 | ae | 56.95 |
| △ | ZLW-3 | .025-200 | DC-200 | 4.61 | .06 | 7.5 | 8.5 | 60 | 50 | 45 | 35 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-46 | M21 | ae | 53.95 |
| △ | ZLW-5 | 5-1500 | 10-600 | 5.81 | .08 | 7.5 | 8.5 | 55 | 40 | 35 | 25 | 30 | 20 | 50 | 40 | 35 | 25 | 30 | 20 | 1-120 | M21 | ae | 61.95 |
| △ | ZLW-6 | .003-100 | DC-100 | 4.58 | .05 | 7.5 | 8.5 | 60 | 50 | 45 | 30 | 35 | 25 | 60 | 45 | 40 | 25 | 30 | 25 | 1-48 | M21 | ae | 64.95 |
| △ | ZLW-8 | .0005-10 | DC-10 | 5.66 | .08 | 7.5 | 8.5 | 60 | 50 | 50 | 40 | 45 | 35 | 60 | 50 | 50 | 40 | 45 | 35 | 1-50 | M21 | ae | 69.95 |
| △ | ZLW-11 | 5-2000 | 10-600 | 6.85 | .10 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 30 | 20 | 45 | 40 | 30 | 20 | 25 | 15 | 1-58 | M21 | ae | 71.95 |
| △ | ZLW-12 | 800-1250 | 50-90 | 6.21 | .13 | — | 7.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-74 | M21 | ae | 71.95 |
| | ZAD-1 | .5-500 | DC-500 | 5.24 | .10 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-92 | M22 | ae | 43.95 |
| | ZAD-1W | 1-750 | DC-750 | 5.56 | .05 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-54 | M22 | ae | 45.95 |
| | ZAD-1-1 | .1-500 | DC-500 | 4.83 | .04 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-52 | M22 | ae | 44.95 |
| | ZAD-2 | 1-1000 | .5-500 | 5.66 | .07 | 7.5 | 8.5 | 45 | 30 | 35 | 20 | 30 | 20 | 45 | 30 | 35 | 20 | 30 | 20 | 1-56 | M22 | ad | 49.95 |
| | ZAD-3 | .025-200 | DC-200 | 4.61 | .06 | 7.5 | 8.5 | 60 | 50 | 45 | 35 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-46 | M22 | ae | 45.95 |
| | ZAD-4 | 5-1250 | .5-500 | 5.71 | .08 | 7.5 | 8.5 | 50 | 40 | 40 | 20 | 30 | 20 | 50 | 40 | 40 | 20 | 30 | 20 | 1-122 | M22 | ad | 51.95 |
| | ZAD-6 | .003-100 | DC-100 | 4.65 | .08 | 7.5 | 8.5 | 60 | 50 | 45 | 30 | 35 | 25 | 60 | 45 | 40 | 25 | 30 | 20 | 1-48 | M22 | ae | 51.95 |
| | ZAD-8 | .0005-10 | DC-10 | 5.79 | .05 | 7.5 | 8.5 | 60 | 50 | 50 | 40 | 45 | 35 | 60 | 50 | 50 | 40 | 45 | 35 | 1-50 | M22 | ae | 54.95 |
| | ZAD-11 | 5-2000 | 10-600 | 7.12 | .12 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 30 | 20 | 45 | 40 | 30 | 20 | 25 | 15 | 1-58 | M22 | ae | 61.95 |
| | ZAD-12 | 800-1250 | 50-90 | 6.21 | .13 | 7.5 | 7.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-74 | M22 | ae | 61.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)

m = mid band (2$f_L$ to $f_U$/2)

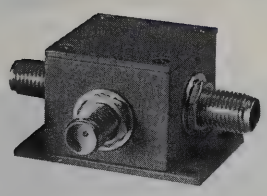
U = upper range ($f_U$/2 to $f_U$)

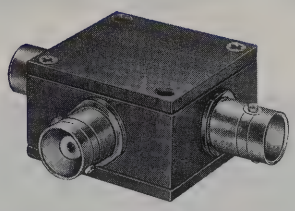
NOTES:

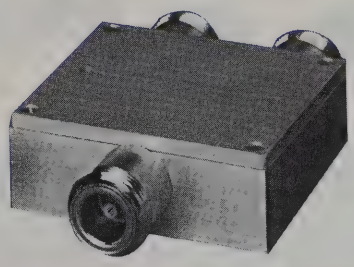
$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
σ Standard deviation
△ Available only with SMA connectors
† Phase detection, positive polarity
* 15 dB min. 8.5 to 10 GHz
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power, 50mW
1b. Peak IF current, 40mA



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


ZEM


ZFM


ZAM

## +7 dBm LO, up to +1 dBm RF

| | MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | CONVERSION LOSS dB Mid-Band m $\sigma$ | CONVERSION LOSS dB Mid-Band m Max. | CONVERSION LOSS dB Total Range Max. | LO-RF ISOLATION, dB L Typ. | LO-RF ISOLATION, dB L Min. | LO-RF ISOLATION, dB M Typ. | LO-RF ISOLATION, dB M Min. | LO-RF ISOLATION, dB U Typ. | LO-RF ISOLATION, dB U Min. | LO-IF ISOLATION, dB L Typ. | LO-IF ISOLATION, dB L Min. | LO-IF ISOLATION, dB M Typ. | LO-IF ISOLATION, dB M Min. | LO-IF ISOLATION, dB U Typ. | LO-IF ISOLATION, dB U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| △ | ZEM-2B | 10-1000 | DC-1000 | 5.74 | .07 | 7.0 | 8.5 | 55 | 50 | 30 | 25 | 25 | 20 | 55 | 45 | 30 | 20 | 25 | 20 | 1-66 | V37 | ad | 59.95 |
| △ | ZEM-4300 | 300-4300 | DC-1000 | 6.65 | .06 | — | 9.5 | 40 | 20 | — | — | 30 | 17 | 15 | 8 | — | — | 15 | 8 | 1-246 | V37 | af | 79.95 |
| | ZFM-1W | 10-750 | DC-750 | 5.42 | .14 | 7.0 | 8.0 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 40 | 40 | 25 | 27 | 20 | 1-54 | K18 | ad | 51.95 |
| | ZFM-2 | 1-1000 | DC-1000 | 5.72 | .06 | 7.5 | 8.5 | 50 | 45 | 40 | 25 | 30 | 25 | 45 | 40 | 35 | 25 | 25 | 20 | 1-66 | K18 | ad | 53.95 |
| | ZFM-3 | 0.04-400 | DC-400 | 4.78 | .03 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 35 | 25 | 55 | 40 | 45 | 30 | 35 | 25 | 1-68 | K18 | ad | 61.95 |
| † | ZFM-4 | 5-1250 | DC-1250 | 5.70 | .34 | 7.5 | 8.5 | 50 | 45 | 40 | 30 | 30 | 25 | 45 | 40 | 35 | 25 | 25 | 20 | 1-70 | K18 | ad | 61.95 |
| | ZFM-5X | 1-1500 | 1-1000 | 5.9 | .10 | 7.0 | 9.0 | 60 | 40 | 40 | 20 | 28 | 17 | 60 | 45 | 45 | 25 | 38 | 20 | — | K18 | ad | 59.95 |
| | ZFM-11 | 1-2000 | 5-600 | 7.03 | .17 | 8.5 | 9.0 | 50 | 45 | 35 | 25 | 25 | 20 | 45 | 40 | 27 | 20 | 25 | 20 | 1-72 | K18 | ad | 89.95 |
| | ZFM-12 | 800-1250 | 50-90 | 5.67 | .12 | — | 7.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-74 | K18 | ad | 79.95 |
| △ | ZFM-2000 | 100-2000 | DC-600 | 7.49 | .20 | 9.5 | 9.5 | — | — | 37 | 20 | — | — | — | — | — | — | 30 | 20 | 1-60 | K18 | ad | 71.95 |
| △ | ZFM-4212 | 2000-4200 | DC-1300 | 5.44 | .088 | — | 8.5 | — | — | 25 | 17 | — | — | — | — | 18 | 10 | — | — | 1-84 | K18 | ad | 54.95 |
| △ | ZAM-42 | 1500-4200 | DC-500 | 5.67 | .11 | — | 8.5 | 25 | 14 | 25 | 14 | 25 | 14 | 18 | 10 | 18 | 10 | 18 | 10 | 1-85 | F14 | af | 54.95 |

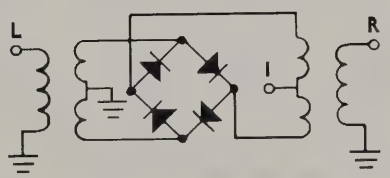
L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

### NSN GUIDE

| MCL NO. | NSN |
|---|---|
| ZAD-1B(BNC) | 5985-00-280-7750 |
| ZAD-4B | 5895-01-127-0376 |
| ZAD-6B | 5895-01-344-7843 |
| ZEM-2 | 5895-01-235-7834 |
| ZFM-1W | 5895-01-412-3037 |
| ZFM-2 | 4935-01-230-3782 |
| ZFM-3 | 5895-01-257-9523 |
| ZFM-3 (SMA) | 5895-01-214-7362 |
| ZFM-3B | 5895-01-381-9289 |
| ZFM-11(SMA) | 6625-01-415-2182 |
| ZLW-1W | 5895-00-607-7010 |
| ZLW-2 | 6920-01-037-1974 |
| ZLW-2B | 5840-01-186-8398 |
| ZP-10514 | 6625-01-108-6156 |
| ZP-10514(BNC) | 5895-01-384-7453 |




## coaxial connections

see case style outline drawings

| PORT | ad | ae | af | ag | hg |
|---|---|---|---|---|---|
| LO | 1 | 1 | 2 | L | L |
| RF | 2 | 3 | 1 | R | X |
| IF | 3 | 2 | 3 | X | R |
| GND EXT. | — | — | — | — | — |
| CASE GND | — | — | — | — | — |
| NOT USED | — | — | — | — | — |

CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

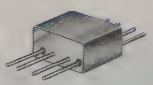
For Custom Versions Of Standard Models Consult Our Applications Dept.

# FREQUENCY MIXERS

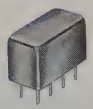
*Plug-In & Coaxial*

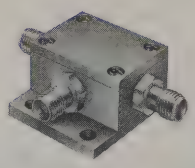
## LEVEL 10 *50 kHz to 8 GHz*

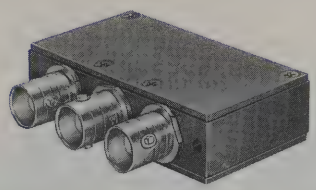
TFM / TUF

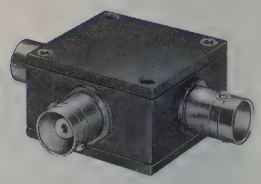

LMX

ROK


SBL / SRA


ZMX


ZP


ZFM

+10 dBm LO, up to +5 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TFM-15 | 10-3000 | 10-800 | 6.75 | .08 | 8.0 | 8.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-126 | B13 | aa | 49.95 |
| TFM-150** | 10-2000 | DC-1000 | 6.19 | .11 | 8.0 | 8.0 | 32 | 25 | 35 | 25 | 35 | 25 | 33 | 20 | 30 | 20 | 30 | 20 | 1-128 | B13 | aa | 45.45 |
| TFM-2LH | 2-1000 | DC-1000 | 5.70 | .177 | 7.5 | 9.2 | 62 | 45 | 44 | 25 | 37 | 25 | 58 | 40 | 45 | 25 | 31 | 18 | 1-262 | B02 | z | 16.95 |
| ❑ TUF-1LH | 2-600 | DC-600 | 6.0 | .17 | 7.0 | 8.0 | 70 | 50 | 50 | 30 | 42 | 25 | 65 | 45 | 50 | 30 | 41 | 22 | 1-316 | B02 | z | 6.25 |
| ❑ TUF-2LH* | 50-1000 | DC-1000 | 5.2 | .30 | 7.0 | 8.5 | 58 | 40 | 44 | 30 | 39 | 25 | 60 | 35 | 50 | 25 | 38 | 20 | 1-262 | B02 | z | 7.20 |
| ❑ TUF-3LH | 0.15-400 | DC-400 | 4.8 | .37 | 7.0 | 8.0 | 67 | 50 | 51 | 30 | 40 | 25 | 67 | 40 | 45 | 25 | 34 | 20 | 1-318 | B02 | z | 8.10 |
| ❑ TUF-5LH | 20-1500 | DC-1000 | 6.9 | .27 | 8.5 | 9.0 | 53 | 40 | 42 | 30 | 38 | 25 | 40 | 25 | 30 | 18 | 22 | 8 | 1-320 | B02 | z | 11.45 |
| ❑ TUF-11ALH | 1400-1900 | 40-500 | 7.0 | .20 | 8.6 | 8.6 | 36 (Typ.) | | 20 (Min.) | | | | 28 (Typ.) | | 15 (Min.) | | | | 1-322 | B02 | z | 18.95 |
| ❑ TUF-860LH | 800-1050 | DC-250 | 6.3 | .27 | 7.9 | 7.9 | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | | | 1-324 | B02 | z | 11.45 |
| LMX-123 | 10-3000 | 10-1000 | 5.94 | .08 | 8.0 | 8.5 | 35 | 25 | 35 | 20 | 30 | 15 | 35 | 25 | 30 | 25 | 30 | 20 | 1-130 | BB48 | q | 69.95 |
| † LMX-148 | 10-1500 | DC-1500 | 6.48 | .08 | 7.0 | 10.0 | 45 | 40 | 35 | 30 | 25 | 20 | 40 | 35 | 35 | 25 | 20 | 12 | 1-132 | BB48 | q | 29.95 |
| LMX-1481 | 3-1100 | DC-1100 | 6.70 | .12 | 8.5 | 9.8 | 65 | 45 | 40 | 25 | 30 | 18 | 57 | 38 | 30 | 20 | 20 | 14 | 1-208 | BB48 | q | 23.95 |
| ROK-2500LH | 1-2500 | DC-500 | 6.4 | .20 | 8.4 | 9.0 | 55 | 40 | 48 | 20 | 30 | 20 | 55 | 38 | 27 | 15 | 22 | 15 | — | PP230 | ah | 32.95 |
| ❑ SBL-1LH | 2-500 | DC-500 | 5.8 | .03 | 7.0 | 8.0 | 75 | 45 | 68 | 35 | 56 | 25 | 61 | 35 | 45 | 25 | 36 | 20 | 1-252 | A06 | d | 5.75 |
| ❑ SBL-1-1LH | .2-400 | DC-400 | 5.2 | .06 | 7.0 | 9.0 | 67 | 45 | 64 | 30 | 51 | 25 | 62 | 30 | 52 | 25 | 34 | 20 | 1-256 | A06 | d | 8.45 |
| ❑ SBL-1XLH | 10-1000 | 5-500 | 6.0 | .12 | 7.5 | 8.5 | 50 | 40 | 40 | 25 | 30 | 20 | 70 | 45 | 55 | 40 | 45 | 30 | 1-258 | A06 | j | 7.45 |
| ❑ SBL-2LH | 5-1000 | DC-1000 | 5.9 | .09 | 7.5 | 9.5 | 67 | 45 | 61 | 30 | 57 | 30 | 68 | 40 | 54 | 30 | 43 | 20 | 1-262 | A06 | h | 8.45 |
| ❑ SBL-3LH | .07-250 | DC-250 | 4.9 | .22 | 7.0 | 8.5 | 60 | 45 | 60 | 35 | 45 | 30 | 57 | 35 | 53 | 30 | 42 | 25 | 1-264 | A06 | d | 8.45 |
| ❑ SBL-11LH | 5-2000 | 10-600 | 7.0 | .11 | 8.5 | 9.5 | 60 | 45 | 45 | 30 | 30 | 20 | 50 | 35 | 30 | 20 | 25 | 16 | 1-254 | A06 | m | 20.95 |
| SRA-2CR | 10-1000 | 5-500 | 5.68 | .12 | 7.5 | 8.0 | 50 | 40 | 40 | 30 | 30 | 20 | 40 | 25 | 30 | 18 | 25 | 15 | 1-242 | A01 | s | 17.95 |
| SRA-215 | .05-1500 | .05-500 | 5.20 | .08 | 7.5 | 9.0 | 25 | 20 | 35 | 25 | 30 | 20 | 25 | 20 | 35 | 25 | 25 | 15 | 1-134 | A01 | m | 28.95 |
| SRA-220 | .05-2000 | .05-500 | 5.59 | .11 | 8.0 | 9.0 | 25 | 20 | 40 | 30 | 30 | 20 | 25 | 20 | 40 | 30 | 25 | 15 | 1-136 | A01 | m | 31.95 |
| NEW ZMX-7GLHR | 3700-7000 | DC-1500 | 5.4 | .30 | — | 8.5 | 33 (Typ.) | | 20 (Min.) | | | | 35 (Typ.) | | 20 (Min.) | | | | — | BU413 | af | 71.95 |
| NEW ZMX-8GLH | 3700-8000 | DC-2000 | 5.5 | .20 | — | 8.5 | 40 (Typ.) | | 20 (Min.) | | | | 18 (Typ.) | | 8 (Min.) | | | | — | BU413 | ad | 74.95 |
| ZP-1LH | 2-600 | DC-600 | 6.0 | .17 | 7.0 | 8.0 | 70 | 50 | 50 | 30 | 42 | 25 | 65 | 45 | 50 | 30 | 41 | 22 | 1-316 | GG60 | ag | 41.95 |
| ZP-2LH* | 50-1000 | DC-1000 | 5.2 | .30 | 7.0 | 8.5 | 58 | 40 | 44 | 30 | 39 | 25 | 60 | 35 | 50 | 25 | 38 | 20 | 1-262 | GG60 | ag | 41.95 |
| ZP-3LH | 0.15-400 | DC-400 | 4.8 | .37 | 7.0 | 8.0 | 67 | 50 | 51 | 30 | 40 | 25 | 67 | 40 | 45 | 25 | 34 | 20 | 1-318 | GG60 | ag | 41.95 |
| ZP-5LH | 20-1500 | DC-1000 | 6.9 | .27 | 8.5 | 9.0 | 53 | 40 | 42 | 30 | 38 | 25 | 40 | 25 | 30 | 18 | 22 | 8 | 1-320 | GG60 | ag | 45.95 |
| ZP-11ALH | 1400-1900 | 40-500 | 7.0 | .20 | 8.6 | 8.6 | 36 (Typ.) | | 20 (Min.) | | | | 28 (Typ.) | | 15 (Min.) | | | | 1-322 | GG60 | ag | 45.95 |
| ZP-860LH | 800-1050 | DC-250 | 6.3 | .27 | 7.9 | 7.9 | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | | | 1-324 | GG60 | ag | 45.95 |
| ZFM-15 | 10-3000 | 10-800 | 6.13 | .14 | 8.0 | 8.5 | 35 | 25 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | 30 | 20 | 1-126 | K18 | ad | 89.95 |
| ZFM-150** | 10-2000 | DC-1000 | 6.05 | .12 | 8.0 | 8.0 | 32 | 25 | 35 | 25 | 35 | 20 | 33 | 20 | 30 | 20 | 25 | 20 | 1-128 | K18 | ad | 69.95 |

L = low range ($f_L$ to 10 $f_L$)  M = mid range (10 $f_L$ to $f_U$/2)  U = upper range ($f_U$/2 to $f_U$)

m = mid band (2$f_L$ to $f_U$/2)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
- σ Standard deviation
- ❑ Non-hermetic
- † Phase detection, positive polarity
- * L=50-100 MHz; M=100-500 MHz
- ** Below 10 MHz IF, conversion loss increase up to 6 dB higher as frequency decreases to DC.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings: 1a. RF power 50mW; 1b. Peak IF current, 40mA

**NSN GUIDE**

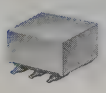
| MCL NO. | NSN |
|---|---|
| LMX-123 | 5895-01-367-9005 |
| LMX-148 | 5962-01-357-4432 |
| TFM-15 | 5895-01-292-2759 |
| ZFM-15 | 5895-01-412-3035 |
| ZFM-150 | 5895-01-217-6878 |



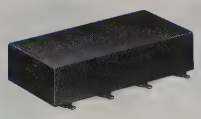
Mini-Circuits®
*INTERNET* http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
*Distribution Centers/* NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

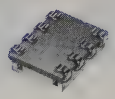
# LEVEL 10 150 kHz to 6 GHz

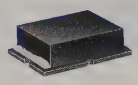
†JMS

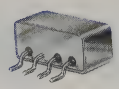

†LRMS

†RMS


SCM


SKY


SYM


TUF-SM

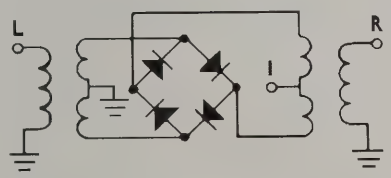
## +10 dBm LO, up to +5 dBm RF

| | MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | JMS-1LH | 2-500 | DC-500 | 5.75 | .10 | 7.0 | 8.0 | 67 | 50 | 55 | 30 | 42 | 25 | 50 | 40 | 45 | 25 | 32 | 20 | — | BH292 | ht | 8.45 |
| | JMS-2LH | 20-1000 | DC-1000 | 6.5 | .10 | 7.5 | 9.0 | 60 | 40 | 48 | 25 | 37 | 20 | 45 | 30 | 35 | 20 | 27 | 11 | — | BH292 | ht | 9.45 |
| NEW | JMS-5LH | 5-1500 | DC-1000 | 6.0 | .20 | 8.0 | 9.5 | 60 | 40 | 50 | 25 | 35 | 20 | 55 | 40 | 35 | 14 | 15 | 6 | — | BH292 | ht | 10.95 |
| | LRMS-1LH | 2-500 | DC-500 | 5.36 | .08 | 7.0 | 8.0 | 58 | 45 | 44 | 25 | 30 | 20 | 55 | 40 | 40 | 25 | 28 | 17 | 1-220 | QQQ130 | w | 7.95 |
| | LRMS-2LH | 5-1000 | DC-1000 | 6.44 | .10 | 8.0 | 9.5 | 58 | 40 | 39 | 20 | 22 | 16 | 52 | 30 | 30 | 17 | 18 | 11 | 1-226 | QQQ130 | w | 8.95 |
| | LRMS-5LH | 10-1500 | DC-900 | 5.27 | .09 | 8.0 | 9.8 | 58 | 35 | 38 | 20 | 25 | 18 | 56 | 30 | 38 | 14 | 17 | 6 | 1-294 | QQQ130 | w | 14.95 |
| | RMS-1LH | 2-500 | DC-500 | 5.36 | .08 | 7.0 | 8.0 | 58 | 45 | 44 | 25 | 30 | 20 | 55 | 40 | 40 | 25 | 28 | 17 | 1-220 | TT100 | w | 7.95 |
| | RMS-2LH | 5-1000 | DC-1000 | 6.44 | .10 | 8.0 | 9.5 | 58 | 40 | 39 | 20 | 22 | 16 | 52 | 30 | 30 | 17 | 18 | 11 | 1-226 | TT100 | w | 8.95 |
| | RMS-5LH | 10-1500 | DC-900 | 5.27 | .09 | 8.0 | 9.8 | 58 | 35 | 38 | 20 | 25 | 18 | 56 | 30 | 38 | 14 | 17 | 6 | 1-294 | TT100 | w | 14.95 |
| | SCM-1LH | 1-500 | DC-500 | 5.75 | .20 | 7.0 | 8.0 | 60 | 40 | 50 | 35 | 40 | 30 | 50 | 40 | 45 | 35 | 40 | 25 | — | YY101 | d | 6.25 |
| | SCM-2LH | 5-1000 | DC-500 | 7.15 | .20 | 8.4 | 9.7 | 65 | 40 | 50 | 25 | 44 | 20 | 58 | 40 | 50 | 25 | 28 | 15 | — | YY101 | d | 7.45 |
| | SCM-5LH | 1250-1800 | DC-500 | 6.0 | .46 | — | 8.8 | 26 (Typ.) | | 17 (Min.) | | | | 18 (Typ.) | | 8 (Min.) | | | | — | YY101 | d | 13.95 |
| | SCM-2500LH | 500-2500 | DC-500 | 5.6 | .20 | 6.8 | 10.0 | 35 (Typ.) | | 20 (Min.) | | | | 18 (Typ.) | | 10 (Min.) | | | | — | YY101 | r | 13.95 |
| NEW | SKY-53LHR | 2800-5300 | DC-500 | 5.7 | .20 | — | 9.5 | 28 (typ.) | | 15 (min.) | | | | 12 (typ.) | | 8 (min.) | | | | — | BJ398 | hp | 16.95 |
| NEW | SKY-60LH | 2500-6000 | DC-1500 | 6.2 | .20 | — | 9.7 | 28 (typ.) | | 17 (min.) | | | | 14 (typ.) | | 8 (min.) | | | | — | BJ398 | je | 16.95 |
| | SYM-11LH | 1-2000 | 10-600 | 7.0 | .10 | 8.3 | 9.85 | 60 | 40 | 45 | 25 | 37 | 25 | 59 | 40 | 33 | 20 | 25 | 20 | 1-296 | TTT167 | x | 11.95 |
| | TUF-1LHSM | 2-600 | DC-600 | 6.0 | .17 | 7.0 | 8.0 | 70 | 50 | 50 | 30 | 42 | 25 | 65 | 45 | 50 | 30 | 41 | 22 | 1-316 | NNN150 | z | 6.25 |
| | TUF-2LHSM* | 50-1000 | DC-1000 | 5.2 | .30 | 7.0 | 8.5 | 58 | 40 | 44 | 30 | 39 | 25 | 60 | 35 | 50 | 25 | 38 | 20 | 1-262 | NNN150 | z | 7.20 |
| | TUF-3LHSM | 0.15-400 | DC-400 | 4.8 | .37 | 7.0 | 8.0 | 67 | 50 | 51 | 30 | 40 | 25 | 67 | 40 | 45 | 25 | 34 | 20 | 1-318 | NNN150 | z | 8.10 |
| | TUF-5LHSM | 20-1500 | DC-1000 | 6.9 | .27 | 8.5 | 9.0 | 53 | 40 | 42 | 30 | 38 | 25 | 40 | 25 | 30 | 18 | 22 | 8 | 1-320 | NNN150 | z | 11.45 |
| | TUF-11ALHSM | 1400-1900 | 40-500 | 7.0 | .20 | 8.6 | 8.6 | 36 (Typ.) | | 20 (Min.) | | | | 28 (Typ.) | | 15 (Min.) | | | | 1-322 | NNN150 | z | 18.95 |
| | TUF-860LHSM | 800-1050 | DC-250 | 6.3 | .27 | 7.9 | 7.9 | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | | | 1-324 | NNN150 | z | 11.45 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)




## pin and coaxial connections see case style outline drawings for pin locations

| PORT | d | h | j | m | q | r | w | x | z | aa | ad | af | ag | ah | ht[1] | hp | je |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 8 | 8 | 8 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | L | 4 | 6 | 5 | 1 |
| RF | 1 | 1 | 3,4^ | 1 | 5 | 8 | 4 | 1 | 1 | 4 | 2 | 1 | R | 2 | 3 | 1 | 5 |
| IF | 3,4^ | 3,4^ | 1 | 3 | 4 | 3 | 5 | 3 | 2 | 2 | 3 | 3 | X | 1 | 2 | 7 | 7 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 1,2,3,6,7 | 2,5,6,7 | 2,3,6 | 4,5,6 | 3 | 3 | — | — | — | 3 | 1,4,5 | 2,3,4,6,8 | 2,3,4,6,8 |
| CASE GND | — | 2,5,6 | 2,5,6,7 | 2,5,6,7 | 1,2,3,6,7 | — | — | — | 3 | 3 | — | — | — | 3 | — | — | — |
| NOT USED | — | — | — | 4 | — | — | — | — | — | — | — | — | — | — | — | — | — |

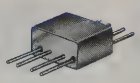
^ pins must be connected together externally
[1] pin connection physically same as w

# FREQUENCY MIXERS

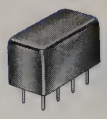
Plug-In & Coaxial

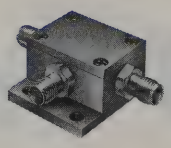
## LEVEL 13 25 kHz to 7 GHz

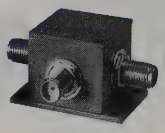
TFM / TUF

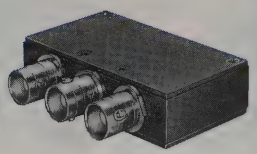

LMX

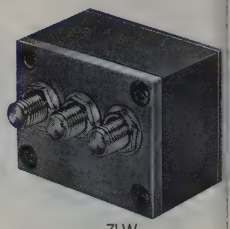
ROK


SBL / SIMA/ SRA


ZMX


ZEM


ZP


ZLW

+13 dBm LO, up to +9 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TFM-1MH | 2-500 | DC-500 | 5.80 | .05 | 7.5 | 8.5 | 50 | 45 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 25 | 20 | 1-138 | B02 | z | 24.95 |
| TFM-3MH | 1-250 | DC-250 | 4.79 | .23 | 7.0 | 8.5 | 50 | 45 | 40 | 30 | 28 | 23 | 45 | 40 | 35 | 25 | 26 | 20 | 1-140 | B02 | z | 24.95 |
| TFM-12MH | 0.5-2000 | 0.2-600 | 6.99 | .16 | 8.0 | 9.5 | 60 | 45 | 35 | 30 | 30 | 25 | 55 | 40 | 30 | 25 | 25 | 20 | 1-104 | B13 | z | 48.95 |
| TFM-42MH | 10-4200 | 10-1000 | 7.46 | .12 | 8.5 | 11 | 35 | 25 | 40 | 25 | 35 | 25 | 35 | 20 | 35 | 25 | 27 | 20 | 1-94 | B13 | aa | 69.95 |
| ❑ TUF-1MH | 2-600 | DC-600 | 6.3 | .12 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 65 | 45 | 48 | 30 | 37 | 22 | 1-138 | B02 | z | 7.25 |
| ❑ TUF-2MH* | 50-1000 | DC-1000 | 6.0 | .25 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 37 | 25 | 55 | 35 | 47 | 20 | 32 | 18 | 1-326 | B02 | z | 8.20 |
| ❑ TUF-3MH | 0.15-400 | DC-400 | 5.0 | .33 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 42 | 25 | 35 | 20 | 1-140 | B02 | z | 9.10 |
| ❑ TUF-5MH | 20-1500 | DC-1000 | 7.0 | .25 | 8.5 | 9.0 | 50 | 40 | 41 | 30 | 35 | 25 | 38 | 25 | 28 | 18 | 20 | 8 | 1-328 | B02 | z | 12.45 |
| ❑ TUF-11AMH | 1400-1900 | 40-500 | 7.4 | .20 | 8.6 | 8.6 | | | 33 (Typ.) | | 20 (Min.) | | | | 24 (Typ.) | | 15 (Min.) | | 1-330 | B02 | z | 19.95 |
| ❑ TUF-860MH | 800-1050 | DC-250 | 6.8 | .32 | 8.3 | 8.3 | | | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | 1-332 | B02 | z | 12.45 |
| ❑ TUF-2500MH | 400-2500 | 30-800 | 7.3 | .15 | 8.5 | 10.0 | | | 32 (Typ.) | | 24 (Min.) | | | | 27 (Typ.) | | 17 (Min.) | | — | B02 | z | 24.95 |
| LMX-123MH | 10-2500 | 10-500 | 6.80 | .074 | 8.5 | 9.6 | 42 | 22 | 35 | 20 | 28 | 20 | 33 | 20 | 36 | 20 | 36 | 15 | 1-298 | BB48 | q | 70.95 |
| LMX-125MH | 0.5-500 | DC-500 | 5.80 | .07 | 7.0 | 9.0 | 45 | 40 | 45 | 40 | 40 | 30 | 45 | 40 | 40 | 35 | 35 | 25 | 1-142 | BB48 | q | 62.95 |
| ROK-186MH | 5-2500 | 10-1000 | 6.57 | .11 | 8.5 | 9.5 | 33 | 25 | 35 | 25 | 25 | 20 | 33 | 20 | 31 | 25 | 27 | 20 | 1-112 | QQ96 | v | 47.95 |
| ❑ SBL-1MH | 1-500 | DC-500 | 5.73 | .08 | 7.5 | 8.5 | 50 | 35 | 45 | 30 | 35 | 25 | 45 | 30 | 40 | 25 | 30 | 20 | 1-144 | A06 | d | 10.45 |
| ❑ SBL-1ZMH | 2-1100 | DC-500 | 6.63 | .10 | 8.0 | 9.0 | 50 | 40 | 40 | 30 | 30 | 20 | 40 | 30 | 25 | 20 | 25 | 15 | 1-260 | A06 | s | 12.45 |
| SIMA-5MH | 2-1500 | DC-1000 | 7.11 | .11 | 8.6 | 9.0 | 70 | 44 | 44 | 23 | 31 | 22 | 57 | 38 | 30 | 20 | 25 | 15 | 1-204 | A06 | n | 28.95 |
| SRA-1MH | .5-500 | DC-500 | 5.65 | .04 | 7.0 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-146 | A01 | e | 14.95 |
| SRA-3MH | .025-200 | DC-200 | 4.77 | .07 | 7.5 | 8.5 | 60 | 50 | 45 | 35 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-148 | A01 | e | 16.95 |
| SRA-2010MH | 10-2000 | DC-600 | 7.50 | .20 | 8.5 | 9.8 | 50 | 45 | 45 | 30 | 40 | 25 | 45 | 45 | 35 | 30 | 35 | 20 | 1-98 | A06 | m | 38.95 |
| NEW ZMX-7GMH | 3700-7000 | DC-2000 | 4.7 | .20 | — | 8.0 | | | 37 (Typ.) | | 20 (Min.) | | | | 17 (Typ.) | | 8 (Min.) | | — | BU413 | ad | 74.95 |
| NEW ZMX-7GMHR | 3700-7000 | DC-1000 | 6.0 | .20 | — | 8.6 | | | 30 (Typ.) | | 20 (Min.) | | | | 35 (Typ.) | | 20 (Min.) | | — | BU413 | af | 75.95 |
| ZEM-4300MH | 300-4300 | DC-1000 | 6.42 | .15 | — | 8.5 | 40 | 20 | — | — | 40 | 20 | 14 | 7 | — | — | 12 | 7 | 1-302 | V37 | af | 89.95 |
| ZEM-M2TMH | 10-2400 | 10-1000 | 6.9 | .10 | 9.0 | 9.5 | 49 | 40 | 43 | 35 | 42 | 35 | 49 | 40 | 44 | 30 | 40 | 30 | — | V37 | hq | 114.95 |
| ZP-1MH | 2-600 | DC-600 | 6.3 | .12 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 65 | 45 | 48 | 30 | 37 | 22 | 1-138 | GG60 | ag | 43.95 |
| ZP-2MH* | 50-1000 | DC-1000 | 6.0 | .25 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 37 | 25 | 55 | 35 | 47 | 20 | 32 | 18 | 1-326 | GG60 | ag | 43.95 |
| ZP-3MH | 0.15-400 | DC-400 | 5.0 | .33 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 42 | 25 | 35 | 20 | 1-140 | GG60 | ag | 43.95 |
| ZP-5MH | 20-1500 | DC-1000 | 7.0 | .25 | 8.5 | 9.0 | 50 | 40 | 41 | 30 | 35 | 25 | 38 | 25 | 28 | 18 | 20 | 8 | 1-328 | GG60 | ag | 47.95 |
| ZP-11AMH | 1400-1900 | 40-500 | 7.4 | .20 | 8.6 | 8.6 | | | 33 (Typ.) | | 20 (Min.) | | | | 24 (Typ.) | | 15 (Min.) | | 1-330 | GG60 | ag | 47.95 |
| ZP-860MH | 800-1050 | DC-250 | 6.8 | .32 | 8.3 | 8.3 | | | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | 1-332 | GG60 | ag | 47.95 |
| ZLW-186MH | 2-2500 | 2-1000 | 6.9 | .11 | 8.5 | 9.5 | 33 | 25 | 35 | 25 | 30 | 20 | 42 | 25 | 49 | 25 | 32 | 20 | — | M21 | ae | 69.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
- σ Standard deviation
- ❑ Non-hermetic
- † Phase detection, positive polarity
- * L=50-100 MHz; M=100-500 MHz
- ✪ Frequency Specified m=1000 - 2000 MHz, L=800 - 2100 MHz, U=2100 - 4200 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings: 1a. RF power 200mW; 1b. Peak IF current, 40mA

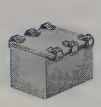
**NSN GUIDE**

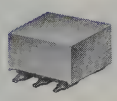
| MCL NO. | NSN |
|---|---|
| ROK-186MH | 5895-01-392-2276 |
| SRA-1MH | 5895-01-391-0113 |
| TFM-3MH | 5895-01-302-7047 |
| TFM-42MH | 5895-01-408-6093 |



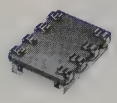
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

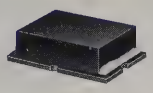
# LEVEL 13 150 kHz to 6 GHz

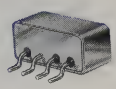

† JMS


† LRMS

† RMS


SKY


SYM


TUF-SM

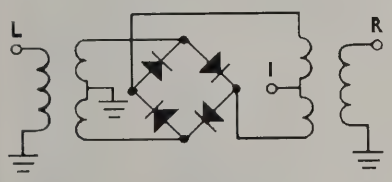
## +13 dBm LO, up to +9 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | m σ | m Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JMS-1MH | 2-500 | DC-500 | 5.75 | .10 | 7.0 | 8.0 | 70 | 55 | 60 | 40 | 44 | 25 | 55 | 42 | 45 | 25 | 35 | 20 | — | BH292 | ht | 9.45 |
| JMS-2MH | 20-1000 | DC-1000 | 7.0 | .15 | 8.4 | 9.5 | 63 | 40 | 50 | 28 | 35 | 20 | 56 | 30 | 47 | 22 | 37 | 20 | — | BH292 | ht | 10.45 |
| NEW JMS-5MH | 5-1500 | DC-1000 | 5.7 | .10 | 8.0 | 9.5 | 67 | 40 | 57 | 25 | 35 | 20 | 60 | 40 | 35 | 18 | 15 | 8 | — | BH292 | ht | 11.95 |
| LRMS-1MH | 2-500 | DC-500 | 5.65 | .08 | 7.0 | 8.0 | 58 | 45 | 44 | 25 | 30 | 20 | 55 | 40 | 36 | 25 | 28 | 17 | 1-222 | QQQ130 | w | 8.95 |
| LRMS-2MH | 5-1000 | DC-1000 | 6.72 | .08 | 8.5 | 9.5 | 55 | 40 | 39 | 20 | 22 | 16 | 52 | 35 | 30 | 17 | 18 | 12 | 1-228 | QQQ130 | w | 9.95 |
| LRMS-2UMH | 10-1000 | 20-500 | 7.0 | .10 | 8.5 | 9.5 | 52 | 40 | 43 | 30 | 33 | 25 | 53 | 30 | 44 | 25 | 39 | 22 | — | QQQ130 | w | 14.45 |
| LRMS-5MH | 10-1500 | DC-900 | 5.67 | .09 | 9.0 | 9.5 | 58 | 40 | 40 | 20 | 26 | 18 | 50 | 30 | 38 | 18 | 17 | 8 | 1-234 | QQQ130 | w | 15.95 |
| RMS-1MH | 2-500 | DC-500 | 5.65 | .08 | 7.0 | 8.0 | 58 | 45 | 44 | 25 | 30 | 20 | 55 | 40 | 36 | 25 | 28 | 17 | 1-222 | TT100 | w | 8.95 |
| RMS-2MH | 5-1000 | DC-1000 | 6.72 | .08 | 8.5 | 9.5 | 55 | 40 | 39 | 20 | 22 | 16 | 52 | 35 | 30 | 17 | 18 | 12 | 1-228 | TT100 | w | 9.95 |
| RMS-2UMH | 10-1000 | 20-500 | 7.0 | .10 | 8.5 | 9.5 | 52 | 40 | 43 | 30 | 33 | 25 | 53 | 30 | 44 | 25 | 39 | 22 | — | TT100 | w | 14.45 |
| RMS-5MH | 10-1500 | DC-900 | 5.67 | .09 | 9.0 | 9.5 | 58 | 40 | 40 | 20 | 26 | 18 | 50 | 30 | 38 | 18 | 17 | 8 | 1-234 | TT100 | w | 15.95 |
| RMS-25MH | 5-2500 | 5-1500 | 7.0 | .20 | 8.5 | 9.8 | 54 | 28 | 32 | 23 | 32 | 20 | 34 | 23 | 32 | 25 | 28 | 17 | — | TT240 | w | 7.95*** |
| ✪ RMS-42MH | 800-4200 | DC-800 | 5.3 | .20 | 9.0 | 10.8 | 35 | 25 | — | — | 28 | 17 | 18 | 10 | — | — | 15 | 7 | — | TT240 | w | 24.95 |
| NEW SKY-53MHR | 2800-5300 | DC-500 | 5.7 | .20 | — | 9.5 | 28 (Typ.) | | 15 (Min.) | | | | 12 (Typ.) | | 8 (Min.) | | | | — | BJ398 | hp | 17.95 |
| NEW SKY-60MH | 2500-6000 | DC-1500 | 6.2 | .20 | — | 9.5 | 28 (Typ.) | | 17 (Min.) | | | | 14 (Typ.) | | 8 (Min.) | | | | — | BJ398 | je | 17.95 |
| SYM-11MH | 50-2000 | 50-1000 | 6.6 | .10 | 8.0 | 9.9 | 55 | 35 | 44 | 25 | 30 | 20 | 40 | 25 | 36 | 20 | 29 | 20 | 1-300 | TTT167 | x | 15.95 |
| TUF-1MHSM | 2-600 | DC-600 | 6.3 | .12 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 65 | 45 | 48 | 30 | 37 | 22 | 1-138 | NNN150 | z | 7.25 |
| TUF-2MHSM* | 50-1000 | DC-1000 | 6.0 | .25 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 37 | 25 | 55 | 35 | 47 | 20 | 32 | 18 | 1-326 | NNN150 | z | 8.20 |
| TUF-3MHSM | 0.15-400 | DC-400 | 5.0 | .33 | 7.0 | 8.0 | 60 | 50 | 46 | 30 | 35 | 25 | 60 | 40 | 42 | 25 | 35 | 20 | 1-140 | NNN150 | z | 9.10 |
| TUF-5MHSM | 20-1500 | DC-1000 | 7.0 | .25 | 8.5 | 9.0 | 50 | 40 | 41 | 30 | 35 | 25 | 38 | 25 | 28 | 18 | 20 | 8 | 1-328 | NNN150 | z | 12.45 |
| TUF-11AMHSM | 1400-1900 | 40-500 | 7.4 | .20 | 8.6 | 8.6 | 33 (Typ.) | | 20 (Min.) | | | | 24 (Typ.) | | 15 (Min.) | | | | 1-330 | NNN150 | z | 19.95 |
| TUF-860MHSM | 800-1050 | DC-250 | 6.8 | .32 | 8.3 | 8.3 | 35 (Typ.) | | 25 (Min.) | | | | 27 (Typ.) | | 18 (Min.) | | | | 1-332 | NNN150 | z | 12.45 |
| TUF-2500MHSM | 400-2500 | 30-800 | 7.3 | .15 | 8.5 | 10.0 | 32 (Typ.) | | 24 (Min.) | | | | 27 (Typ.) | | 17 (Min.) | | | | — | NNN150 | z | 24.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)




## pin and coaxial connections see case style outline drawings

| PORT | d | e | m | n | q | s | v | w | x | z | aa | ad | ae | af | ag | hq | ht[1] | hp | je |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 8 | 8 | 8 | 1 | 5 | 1 | 2 | 4 | 1 | 1 | 1 | 2 | L | 3 | 6 | 5 | 1 |
| RF | 1 | 1 | 1 | 1 | 5 | 8 | 11 | 4 | 1 | 1 | 4 | 2 | 3 | 1 | R | 2 | 3 | 1 | 5 |
| IF | 3,4^ | 3,4^ | 3 | 3 | 4 | 3 | 2 | 5 | 3 | 2 | 2 | 3 | 2 | 3 | X | 1 | 2 | 7 | 7 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,4,5,6,7 | 1,2,3,6,7 | 2,5,6,7 | 1,3,4,6,7,8,9,10,12 | 2,3,6 | 4,5,6 | 3 | 3 | -- | -- | -- | -- | -- | 1,4,5 | 2,3,4,6,8 | 2,3,4,6,8 |
| CASE GND | — | 2 | 2,5,6,7 | 2,4,5,6,7 | 1,2,3,6,7 | 2,5,6,7 | 1,3,4,6,7,8,9,10,12 | -- | -- | 3 | 3 | -- | -- | -- | -- | -- | -- | -- | -- |
| NOT USED | — | — | 4 | — | | 4 | -- | — | — | — | — | — | — | — | — | — | -- | -- | -- |

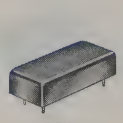
^ pins must be connected together externally
[1] pin connection physically same as w

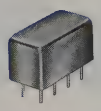
In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.

# FREQUENCY MIXERS

Plug-In

## LEVEL 17 10 kHz to 3 GHz


GRA


SBL/SIMA

SRA

TFM/TUF

TAK

### +17 dBm LO, up to +10 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band $\bar{x}$ | m σ | Mid-Band Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRA-1H | .5-500 | DC-500 | 5.87 | .09 | 7.5 | 8.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-50 | D08 | y | 21.95 |
| GRA-3H | .05-200 | DC-200 | 4.85 | .07 | 7.0 | 7.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-156 | D08 | y | 24.95 |
| GRA-6H | .01-50 | DC-50 | 5.04 | .05 | 6.0 | 7.0 | 50 | 45 | 45 | 30 | 35 | 25 | 50 | 40 | 47 | 35 | 32 | 25 | 1-162 | D08 | y | 34.95 |
| ❑ SBL-173H | 5-1200 | 1-1200 | 5.70 | .10 | 7.0 | 8.5 | 40 | 35 | 35 | 25 | 35 | 20 | 40 | 35 | 35 | 20 | 30 | 20 | — | A06 | u,f | 15.95 |
| ❑ SBL-2500H | 5-2500 | 1-1000 | 5.50 | .10 | 7.5 | 10.5 | 46 | 35 | 44 | 30 | 35 | 25 | 50 | 35 | 44 | 27 | 32 | 19 | — | A06 | f | 33.95 |
| SRA-1H | .5-500 | DC-500 | 6.01 | .08 | 7.5 | 8.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-150 | A01 | e | 20.95 |
| SRA-1WH | 1-750 | DC-750 | 5.85 | .11 | 7.5 | 8.5 | 50 | 40 | 45 | 25 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-152 | A01 | f | 24.95 |
| SRA-2H | 2-1000 | DC-1000 | 6.34 | .14 | 7.5 | 10.0 | 50 | 40 | 35 | 25 | 35 | 25 | 45 | 30 | 30 | 20 | 25 | 20 | 1-154 | A01 | f | 38.95 |
| SRA-3H | .05-200 | DC-200 | 5.18 | .05 | 7.0 | 7.5 | 50 | 45 | 40 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-156 | A01 | e | 22.95 |
| SRA-6H | .01-50 | DC-50 | 4.97 | .06 | 6.0 | 7.0 | 50 | 45 | 45 | 30 | 35 | 25 | 50 | 40 | 47 | 35 | 32 | 25 | 1-162 | A01 | e | 38.95 |
| SRA-11H | 10-3000 | 10-1000 | 6.83 | .09 | 10.0 | 12.0 | 27 | 20 | 25 | 18 | 23 | 16 | 27 | 20 | 25 | 18 | 23 | 16 | 1-158 | A01 | m | 47.95 |
| SRA-173H | 5-1200 | DC-1200 | 5.38 | .05 | 7.0 | 8.5 | 40 | 35 | 35 | 25 | 35 | 20 | 40 | 35 | 35 | 20 | 30 | 20 | 1-160 | A01 | u,f | 31.95 |
| SIMA-5H | 2-1500 | DC-1000 | 6.94 | .07 | 8.5 | 8.5 | 65 | 35 | 44 | 23 | 40 | 22 | 54 | 25 | 30 | 23 | 25 | 13 | 1-202 | A06 | m | 32.95 |

### +17 dBm LO, up to +14 dBm RF

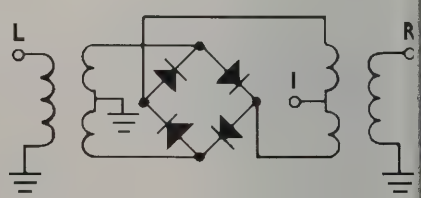
| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TFM-1H | 2-500 | DC-500 | 6.14 | .11 | 7.5 | 8.5 | 50 | 45 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 25 | 20 | 1-164 | B02 | z | 25.95 |
| TFM-2H | 5-1000 | DC-1000 | 6.12 | .12 | 7.0 | 10.0 | 50 | 45 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 25 | 17 | 1-166 | B02 | z | 36.95 |
| TFM-3H | .1-250 | DC-250 | 4.58 | .11 | 7.0 | 8.5 | 50 | 45 | 40 | 30 | 28 | 23 | 45 | 40 | 35 | 25 | 26 | 20 | 1-170 | B02 | z | 25.95 |
| † TFM-4H | 5-1200 | DC-1200 | 5.24 | .05 | 8.0 | 9.0 | 50 | 40 | 35 | 25 | 30 | 20 | 50 | 40 | 35 | 20 | 30 | 20 | 1-174 | B13 | z | 39.45 |
| ❑ TUF-1H | 2-600 | DC-600 | 5.90 | .18 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 62 | 45 | 48 | 30 | 33 | 22 | 1-164 | B02 | z | 9.25 |
| ❑ TUF-2H | 50-1000 | DC-1000 | 6.20 | .22 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 58 | 35 | 44 | 25 | 28 | 18 | 1-166 | B02 | z | 10.20 |
| ❑ TUF-3H | 0.15-400 | DC-400 | 5.00 | .33 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 40 | 30 | 60 | 40 | 45 | 25 | 35 | 20 | 1-170 | B02 | z | 11.10 |
| ❑ TUF-5H | 20-1500 | DC-1000 | 7.50 | .17 | 8.5 | 9.0 | 62 | 55 | 50 | 40 | 38 | 25 | 40 | 25 | 29 | 18 | 20 | 8 | 1-334 | B02 | z | 14.45 |
| ❑ TUF-11AH | 1400-1900 | 40-500 | 7.30 | .28 | 9.0 | 9.0 | | | 35 (Typ.) | 25 (Min.) | | | | | 30 (Typ.) | 15 (Min.) | | | 1-336 | B02 | z | 21.95 |
| ❑ TUF-860H | 800-1050 | DC-250 | 6.80 | .31 | 8.3 | 8.3 | | | 38 (Typ.) | 25 (Min.) | | | | | 24 (Typ.) | 18 (Min.) | | | 1-338 | B02 | z | 14.45 |
| TAK-1H | 2-500 | DC-500 | 5.93 | .08 | 7.5 | 8.5 | 50 | 40 | 40 | 30 | 30 | 25 | 45 | 35 | 35 | 25 | 25 | 20 | 1-164 | A05 | e | 21.45 |
| TAK-1WH | 5-750 | DC-750 | 5.71 | .08 | 7.5 | 9.0 | 50 | 40 | 40 | 30 | 30 | 25 | 45 | 35 | 35 | 25 | 30 | 20 | 1-168 | A05 | f | 25.95 |
| TAK-3H | .05-300 | DC-300 | 4.82 | .09 | 7.0 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 50 | 40 | 35 | 25 | 25 | 20 | 1-172 | A05 | e | 23.45 |
| ❑ SBL-173SH | 5-1200 | 1-1200 | 5.7 | .10 | 7.0 | 8.5 | 40 | 35 | 35 | 25 | 35 | 20 | 40 | 35 | 35 | 20 | 30 | 20 | — | A06 | u,f | 21.95 |
| SRA-173SH | 5-1200 | 1-1200 | 5.7 | .10 | 7.0 | 8.5 | 40 | 35 | 35 | 25 | 35 | 20 | 40 | 35 | 35 | 20 | 30 | 20 | — | A06 | u,f | 33.95 |
| SRA-2500SH | 5-2500 | 1-1000 | 5.8 | .10 | 7.5 | 10.5 | 40 | 25 | 37 | 28 | 30 | 18 | 50 | 35 | 42 | 25 | 25 | 17 | — | A06 | f | 35.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

m = mid band (2$f_L$ to $f_U$/2)

NOTES:

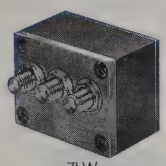
$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
σ Standard deviation
❑ Non-hermetic
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power 200mW 1b. Peak IF current, 40mA
2. Two-Tone 3rd order IM below IF, each tone at 0dBm (200 and 202 MHz), LO at +17dBm (180 MHz). All models 60dB typ., 55dB min. , except 55 dB typ., 45 dBm min. for TFM-3H, TAK-3H, ZFM-3H, ZLW-3SH, ZAD-3SH.

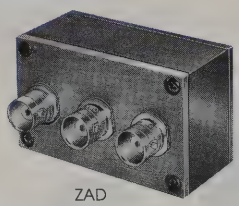


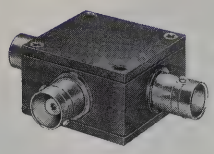


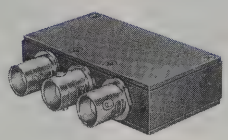

Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

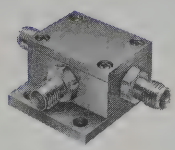
# LEVEL 17 50 kHz to 8 GHz


ZLW


ZAD


ZFM


ZP


ZMX

## +17 dBm LO, up to +10 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZLW-1H | .5-500 | DC-500 | 6.13 | .08 | 7.5 | 8.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-150 | M21 | ae | 56.95 |
| ZLW-1WH | 1-750 | DC-750 | 6.07 | .13 | 7.5 | 8.5 | 50 | 45 | 45 | 25 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-152 | M21 | ae | 59.95 |
| ZLW-2H | 2-1000 | DC-1000 | 6.34 | .14 | 7.5 | 10.0 | 50 | 40 | 35 | 25 | 35 | 25 | 45 | 35 | 30 | 20 | 25 | 20 | 1-154 | M21 | ae | 64.95 |
| ZLW-3H | .05-200 | DC-200 | 5.18 | .05 | 7.0 | 7.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-156 | M21 | ae | 58.95 |
| ZLW-11H | 10-3000 | 10-1000 | 6.83 | .09 | 10.0 | 12.0 | 27 | 20 | 25 | 18 | 23 | 16 | 27 | 20 | 25 | 18 | 23 | 16 | 1-158 | M21 | ae | 99.95 |
| ZAD-1H | .5-500 | DC-500 | 6.16 | .08 | 7.5 | 8.5 | 50 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-150 | M22 | ae | 48.95 |
| ZAD-1WH | 1-750 | DC-750 | 6.16 | .09 | 7.5 | 8.5 | 50 | 45 | 45 | 25 | 35 | 25 | 45 | 35 | 40 | 25 | 30 | 20 | 1-152 | M22 | ae | 52.95 |
| ZAD-2H | 2-1000 | DC-1000 | 6.22 | .15 | 7.5 | 10.0 | 50 | 40 | 35 | 25 | 35 | 25 | 45 | 35 | 30 | 20 | 25 | 20 | 1-154 | M22 | ae | 59.95 |
| ZAD-3H | .05-200 | DC-200 | 4.89 | .09 | 7.0 | 7.5 | 55 | 45 | 45 | 30 | 35 | 25 | 45 | 35 | 40 | 30 | 30 | 20 | 1-156 | M22 | ae | 50.95 |
| ZAD-11H | 10-3000 | 10-1000 | 6.83 | .09 | 10.0 | 12.0 | 27 | 20 | 25 | 18 | 23 | 16 | 27 | 20 | 25 | 18 | 23 | 16 | 1-158 | M22 | ae | 89.95 |

## +17 dBm LO, up to +14 dBm RF

| | MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ZFM-1H | 2-500 | DC-500 | 6.14 | .11 | 7.5 | 8.5 | 50 | 45 | 40 | 30 | 30 | 25 | 45 | 35 | 35 | 25 | 25 | 20 | 1-164 | K18 | ad | 64.95 |
| | ZFM-2H | 5-1000 | DC-1000 | 6.12 | .12 | 7.0 | 10.0 | 50 | 40 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 25 | 17 | 1-166 | K18 | ad | 71.95 |
| | ZFM-3H | .05-300 | DC-300 | 5.18 | .11 | 7.0 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 50 | 40 | 35 | 25 | 25 | 20 | 1-172 | K18 | ad | 64.95 |
| † | ZFM-4H | 5-1200 | DC-1200 | 4.97 | .11 | 8.0 | 9.0 | 50 | 40 | 35 | 25 | 30 | 20 | 50 | 40 | 35 | 20 | 30 | 20 | 1-174 | K18 | ad | 73.95 |
| | ZP-1H | 2-600 | DC-600 | 5.90 | .18 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 62 | 45 | 48 | 30 | 33 | 22 | 1-164 | GG60 | ag | 45.95 |
| | ZP-2H | 50-1000 | DC-1000 | 6.20 | .22 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 58 | 35 | 44 | 25 | 28 | 18 | 1-166 | GG60 | ag | 45.95 |
| | ZP-3H | 0.15-400 | DC-400 | 5.00 | .33 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 40 | 30 | 60 | 40 | 45 | 25 | 35 | 20 | 1-170 | GG60 | ag | 45.95 |
| | ZP-5H | 20-1500 | DC-1000 | 7.50 | .17 | 8.5 | 9.0 | 62 | 55 | 50 | 40 | 38 | 25 | 40 | 25 | 29 | 18 | 20 | 8 | 1-334 | GG60 | ag | 49.95 |
| | ZP-11AH | 1400-1900 | 40-500 | 7.30 | .28 | 9.0 | 9.0 | 35 (Typ.) | | 25 (Min.) | | | | 30 (Typ.) | | 15 (Min.) | | | | 1-336 | GG60 | ag | 49.95 |
| | ZP-860H | 800-1050 | DC-250 | 6.80 | .31 | 8.3 | 8.3 | 38 (Typ.) | | 25 (Min.) | | | | 24 (Typ.) | | 18 (Min.) | | | | 1-338 | GG60 | ag | 49.95 |
| NEW | ZMX-7GHR | 3700-7000 | DC-1000 | 5.3 | .30 | — | 8.5 | 33 (Typ.) | | 20 (Min.) | | | | 34 (Typ.) | | 20 (Min.) | | | | — | BU413 | af | 84.95 |
| NEW | ZMX-8GH | 3700-8000 | DC-2000 | 5.8 | .30 | — | 8.5 | 40 (Typ.) | | 20 (Min.) | | | | 18 (Typ.) | | 8 (Min.) | | | | — | BU413 | ad | 89.95 |
| | ZLW-1SH | 2-500 | DC-500 | 5.93 | .08 | 7.5 | 8.5 | 50 | 40 | 40 | 30 | 30 | 25 | 45 | 35 | 35 | 25 | 25 | 20 | 1-164 | M21 | ae | 62.95 |
| | ZLW-1WSH | 5-750 | DC-750 | 5.83 | .07 | 7.5 | 9.0 | 50 | 45 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 30 | 20 | 1-168 | M21 | ae | 66.95 |
| | ZLW-3SH | .05-300 | DC-300 | 4.65 | .09 | 7.0 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 50 | 40 | 35 | 25 | 25 | 20 | 1-172 | M21 | ae | 64.95 |
| | ZAD-1SH | 2-500 | DC-500 | 5.98 | .08 | 7.5 | 8.5 | 50 | 40 | 40 | 30 | 30 | 25 | 45 | 35 | 35 | 25 | 25 | 20 | 1-164 | M22 | ae | 54.95 |
| | ZAD-1WSH | 5-750 | DC-750 | 5.64 | .08 | 7.5 | 9.0 | 50 | 45 | 40 | 30 | 30 | 20 | 45 | 40 | 35 | 25 | 30 | 20 | 1-168 | M22 | ae | 56.95 |
| | ZAD-3SH | .05-300 | DC-300 | 5.08 | .09 | 7.0 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 50 | 40 | 35 | 25 | 25 | 20 | 1-172 | M22 | ae | 55.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

### NSN GUIDE

| MCL NO. | NSN | MIL-M-28837/1* |
|---|---|---|
| GRA-1H | 5895-01-284-6870 | |
| GRA-3H | 5895-01-171-0974 | |
| SRA-1H | 6625-00-594-0223 | 08 |
| SRA-1WH | 5895-00-576-0716 | |
| SRA-2H | 5895-01-063-1078 | |
| SRA-3H | 5895-01-117-4537 | |
| SRA-11H | 5895-01-192-0173 | |
| SRA-11H-TX | 5895-01-137-9278 | |
| ZAD-1WH | 5895-01-045-4647 | |
| ZAD-3H | 5895-01-149-0771 | |
| ZLW-1H | 5985-01-080-7637 | |
| ZLW-1HB | 5962-01-045-7500 | |
| ZLW-1HB(SMA) | 5895-01-141-4646 | |

* units are not QPL listed

### pin and coaxial connections

see case style outline drawings

| PORT | e | f | m | u | x | y | z | ad | ae | af | ag |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 8 | 3,4 ^ | 2 | 1 | 4 | 1 | 1 | 2 | L |
| RF | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 2 | 3 | 1 | R |
| IF | 3,4 ^ | 3,4 ^ | 3 | 8 | 3 | 4 | 2 | 3 | 2 | 3 | X |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 4,5,6 | 2,3,5 | 3 | — | — | — | — |
| CASE GND | 2 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | — | — | 3 | — | — | — | — |
| NOT USED | — | — | 4 | — | — | — | — | — | — | — | — |

^ pins must be connected together externally

CAPD now available! computer-automated performance data

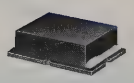
## In Stock... Immediate Delivery

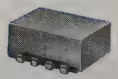
For Custom Versions Of Standard Models Consult Our Applications Dept.

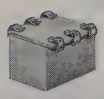
# FREQUENCY MIXERS

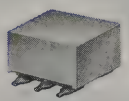
Surface Mount

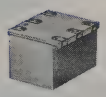
## LEVEL 17 150 kHz to 6 GHz

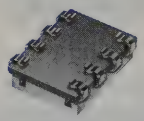

SYM

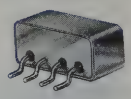

JYM


†JMS


†LRMS


†RMS


SKY


TUF-SM

### +17 dBm LO, up to +10 dBm RF

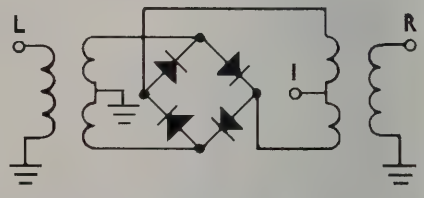
| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SYM-11H | 50-2000 | 50-1950 | 6.3 | .10 | 7.5 | 9.0 | 45 | 35 | 40 | 25 | 37 | 25 | 40 | 25 | 32 | 20 | 30 | 20 | 1-304 | TTT167 | x | 17.95 |
| JYM-20H | 2-2000 | 4-700 | 5.7 | .20 | 8.5 | 9.0 | 40 | 30 | 44 | 28 | 40 | 25 | 40 | 35 | 40 | 22 | 29 | 15 | — | BJ293 | hp | 17.95 |
| JYM-28H | 400-2800 | 4-700 | 6.3 | .20 | 8.0 | 9.0 | 40 (Typ.) | | 25 (Min.) | | | | 30 (Typ.) | | 15 (Min.) | | | | — | BJ293 | hp | 21.95 |
| JYM-30H | 2-3000 | 4-1400 | 6.0 | .20 | 8.9 | 10.6 | 40 | 30 | 40 | 25 | 30 | 25 | 40 | 35 | 30 | 20 | 22 | 15 | — | BJ293 | hp | 23.95 |

### +17 dBm LO, up to +14 dBm RF

| | MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | LO-IF ISOLATION, dB L Typ. | Min. | M Typ. | Min. | U Typ. | Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | JMS-1H | 2-500 | DC-500 | 5.90 | .10 | 7.0 | 8.5 | 60 | 45 | 50 | 25 | 37 | 22 | 55 | 45 | 50 | 25 | 37 | 22 | — | BH292 | ht | 11.45 |
| | JMS-2H | 20-1000 | DC-1000 | 7.00 | .15 | 8.4 | 9.5 | 63 | 40 | 50 | 28 | 35 | 20 | 56 | 30 | 47 | 22 | 37 | 20 | — | BH292 | ht | 12.45 |
| NEW | JMS-5H | 5-1500 | DC-1000 | 5.90 | .10 | 8.0 | 9.5 | 70 | 50 | 50 | 25 | 35 | 20 | 60 | 40 | 35 | 18 | 20 | 8 | — | BH292 | ht | 12.95 |
| | LRMS-1H | 2-500 | DC-500 | 6.25 | .034 | 7.0 | 8.5 | 55 | 44 | 44 | 25 | 33 | 20 | 50 | 34 | 45 | 25 | 37 | 22 | 1-306 | QQQ130 | w | 10.95 |
| | LRMS-1WH | 10-750 | DC-750 | 7.00 | .11 | 8.5 | 8.8 | 55 | 40 | 43 | 22 | 28 | 20 | 52 | 30 | 38 | 22 | 29 | 20 | 1-308 | QQQ130 | w | 11.95 |
| | LRMS-2H | 5-1000 | DC-900 | 6.98 | .054 | 8.5 | 9.3 | 55 | 40 | 39 | 22 | 33 | 20 | 52 | 30 | 45 | 22 | 30 | 17 | 1-310 | QQQ130 | w | 11.95 |
| | LRMS-2UH | 10-1000 | 10-750 | 7.10 | .083 | 9.2 | 9.9 | 50 | 40 | 38 | 30 | 30 | 23 | 50 | 30 | 40 | 25 | 34 | 22 | 1-312 | QQQ130 | w | 14.45 |
| | LRMS-5H | 10-1500 | DC-900 | 6.36 | .05 | 8.0 | 9.8 | 65 | 40 | 36 | 20 | 22 | 15 | 50 | 30 | 30 | 18 | 17 | 7 | 1-250 | QQQ130 | w | 17.95 |
| | RMS-1H | 2-500 | DC-500 | 6.25 | .034 | 7.0 | 8.5 | 55 | 44 | 44 | 25 | 33 | 20 | 50 | 34 | 45 | 25 | 37 | 22 | 1-306 | TT100 | w | 10.95 |
| | RMS-1WH | 10-750 | DC-750 | 7.00 | .11 | 8.5 | 8.8 | 55 | 40 | 43 | 22 | 28 | 20 | 52 | 30 | 38 | 22 | 29 | 20 | 1-308 | TT100 | w | 11.95 |
| | RMS-2H | 5-1000 | DC-900 | 6.98 | .054 | 8.5 | 9.3 | 55 | 40 | 39 | 22 | 33 | 20 | 52 | 30 | 45 | 22 | 30 | 17 | 1-310 | TT100 | w | 11.95 |
| | RMS-2UH | 10-1000 | 10-750 | 7.10 | .083 | 9.2 | 9.9 | 50 | 40 | 38 | 30 | 30 | 23 | 50 | 30 | 40 | 25 | 34 | 22 | 1-312 | TT100 | w | 14.45 |
| | RMS-5H | 10-1500 | DC-900 | 6.36 | .05 | 8.0 | 9.8 | 65 | 40 | 36 | 20 | 22 | 15 | 50 | 30 | 30 | 18 | 17 | 7 | 1-250 | TT100 | w | 17.95 |
| NEW | SKY-53HR | 2800-5300 | DC-500 | 5.70 | .20 | — | 9.5 | 28 (Typ.) | | 15 (Min.) | | | | 12 (Typ.) | | 8 (Min.) | | | | — | BJ398 | hp | 18.95 |
| NEW | SKY-60H | 2500-6000 | DC-1500 | 6.20 | .20 | — | 9.7 | 28 (Typ.) | | 17 (Min.) | | | | 14 (Typ.) | | 8 (Min.) | | | | — | BJ398 | je | 18.95 |
| | TUF-1HSM | 2-600 | DC-600 | 5.90 | .18 | 7.0 | 8.0 | 68 | 50 | 50 | 30 | 43 | 25 | 62 | 45 | 48 | 30 | 33 | 22 | 1-164 | NNN150 | z | 9.25 |
| | TUF-2HSM | 50-1000 | DC-1000 | 6.20 | .22 | 7.5 | 9.0 | 58 | 40 | 47 | 30 | 42 | 25 | 58 | 35 | 44 | 25 | 28 | 18 | 1-166 | NNN150 | z | 10.20 |
| | TUF-3HSM | 0.15-400 | DC-400 | 5.00 | .33 | 7.0 | 8.0 | 60 | 50 | 50 | 35 | 40 | 30 | 60 | 40 | 45 | 25 | 35 | 20 | 1-170 | NNN150 | z | 11.10 |
| | TUF-5HSM | 20-1500 | DC-1000 | 7.50 | .17 | 8.5 | 9.0 | 62 | 55 | 50 | 40 | 38 | 25 | 40 | 25 | 29 | 18 | 20 | 8 | 1-334 | NNN150 | z | 14.45 |
| | TUF-11AHSM | 1400-1900 | 40-500 | 7.30 | .28 | 9.0 | 9.0 | 35 (Typ.) | | 25 (Min.) | | | | 30 (Typ.) | | 15 (Min.) | | | | 1-336 | NNN150 | z | 21.95 |
| | TUF-860HSM | 800-1050 | DC-250 | 6.80 | .31 | 8.3 | 8.3 | 38 (Typ.) | | 25 (Min.) | | | | 24 (Typ.) | | 18 (Min.) | | | | 1-338 | NNN150 | z | 14.45 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

m = mid band (2$f_L$ to $f_U$/2)




NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
- σ Standard deviation
- † Phase detection, positive polarity
- A. Environmental specifications and re-flow soldering information available in General Information Section.
- B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Level 17 mixers, RF power 200mW
  - 1b. Level 23 mixers, RF power 350mW
  - 1c. Peak IF current, 40mA
- 2. Level 17 mixers, Two-Tone 3rd order IM below IF, each tone at 0dBm (200 and 202 MHz), LO at +17dBm (180 MHz). All models 60dB typ., 55dB min.

### pin connections

see case style outline drawings

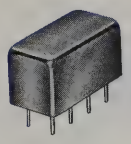
| PORT | w | x | z | hp | ht[1] | je |
|---|---|---|---|---|---|---|
| LO | 1 | 2 | 4 | 5 | 6 | 1 |
| RF | 4 | 1 | 1 | 1 | 3 | 5 |
| IF | 5 | 3 | 2 | 7 | 2 | 7 |
| GND EXT. | 2,3,6 | 4,5,6 | 3 | 2,3,4,6,8 | 1,4,5 | 2,3,4,6,8 |
| CASE GND | — | — | 3 | — | — | — |
| NOT USED | — | — | — | — | — | — |

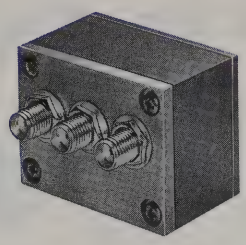
[1] pin connection physically same as w

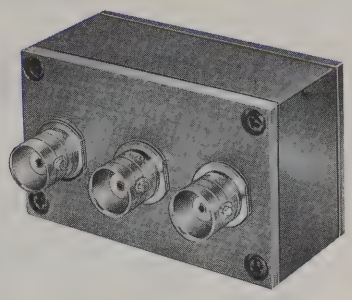


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# LEVEL 23 10 kHz to 2.5 GHz


RAY


ZMY


ZAY

## +23 dBm LO, up to +15 dBm RF

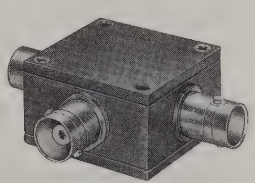
| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RAY-1 | 5-500 | DC-500 | 6.57 | .09 | 7.5 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-176 | A01 | e | 40.95 |
| RAY-2 | 10-1000 | DC-1000 | 6.89 | .22 | 8.5 | 10.0 | 50 | 35 | 40 | 30 | 35 | 25 | 50 | 35 | 35 | 25 | 25 | 20 | 1-178 | A01 | f | 64.45 |
| RAY-3 | .07-200 | DC-200 | 5.53 | .08 | 7.5 | 8.0 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-180 | A01 | e | 40.95 |
| RAY-6 | 0.03-50 | DC-50 | 5.36 | .15 | 7.5 | 8.5 | 60 | 50 | 45 | 30 | 35 | 25 | 60 | 45 | 40 | 25 | 30 | 20 | 1-182 | A01 | d | 52.45 |
| RAY-6U | 0.01-100 | DC-100 | 5.09 | .15 | 7.0 | 8.0 | 60 | 50 | 50 | 40 | 40 | 30 | 50 | 45 | 40 | 30 | 35 | 25 | 1-216 | A01 | e | 46.95 |
| RAY-11 | 100-2500 | DC-500 | 6.23 | .21 | 9.0 | 9.0 | 35 | 25 | 32 | 25 | 32 | 25 | 14 | 10 | 20 | 10 | 20 | 10 | 1-314 | A01 | s | 74.95 |
| ZMY-1 | 5-500 | DC-500 | 6.62 | .10 | 7.5 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-176 | M21 | ae | 67.95 |
| ZMY-2 | 10-1000 | DC-1000 | 6.89 | .22 | 8.5 | 10.0 | 50 | 35 | 40 | 30 | 35 | 25 | 50 | 35 | 35 | 25 | 25 | 20 | 1-178 | M21 | ae | 84.95 |
| ZMY-3 | .07-200 | DC-200 | 5.53 | .08 | 7.5 | 8.0 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-180 | M21 | ae | 69.95 |
| ZAY-1 | 5-500 | DC-500 | 6.57 | .09 | 7.5 | 8.5 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-176 | M22 | ae | 64.95 |
| ZAY-2 | 10-1000 | DC-1000 | 6.89 | .22 | 8.5 | 10.0 | 50 | 35 | 40 | 30 | 35 | 25 | 50 | 35 | 35 | 25 | 25 | 20 | 1-178 | M22 | ae | 84.95 |
| ZAY-3 | .07-200 | DC-200 | 5.53 | .08 | 7.5 | 8.0 | 55 | 45 | 40 | 30 | 30 | 25 | 55 | 45 | 40 | 30 | 30 | 20 | 1-180 | M22 | ae | 64.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

SAY


ZFY

## +23 dBm LO, up to +20 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | σ | Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAY-1 | 0.1-500 | .01-500 | 4.85 | .18 | 6.0 | 7.5 | 40 | 20 | 46 | 35 | 40 | 30 | 37 | 23 | 46 | 35 | 40 | 30 | 1-184 | A01 | m | 62.95 |
| SAY-2 | 0.1-1000 | .01-500 | 5.40 | .24 | 7.5 | 9.5 | 40 | 20 | 40 | 30 | 30 | 25 | 37 | 23 | 40 | 25 | 25 | 15 | 1-186 | A01 | m | 67.95 |
| SAY-11 | 10-2400 | 5-1000 | 7.40 | .09 | 8.5 | 10 | 28 | 20 | 26 | 20 | 25 | 20 | 28 | 20 | 26 | 20 | 25 | 20 | 1-188 | A01 | m | 72.95 |
| ZFY-1 | 0.1-500 | .01-500 | 4.85 | .18 | 6.0 | 7.5 | 40 | 20 | 46 | 35 | 40 | 30 | 37 | 23 | 46 | 35 | 40 | 30 | 1-184 | K18 | ad | 74.95 |
| ZFY-2 | 0.1-1000 | .01-500 | 5.40 | .24 | 7.5 | 9.5 | 40 | 20 | 40 | 30 | 30 | 25 | 37 | 23 | 40 | 25 | 25 | 15 | 1-186 | K18 | ad | 79.95 |
| ZFY-11 | 10-2400 | 5-1000 | 7.40 | .09 | 8.5 | 10 | 28 | 20 | 25 | 20 | 25 | 20 | 28 | 20 | 26 | 20 | 25 | 20 | 1-188 | K18 | ad | 84.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

## pin and coaxial connections

see case style outline drawings

| PORT | d | e | f | m | s | ad | ae |
|---|---|---|---|---|---|---|---|
| LO | 8 | 8 | 8 | 8 | 1 | 1 | 1 |
| RF | 1 | 1 | 1 | 1 | 8 | 2 | 3 |
| IF | 3,4^ | 3,4^ | 3,4^ | 3 | 3 | 3 | 2 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | | |
| CASE GND | — | 2 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | | |
| NOT USED | — | — | — | 4 | 4 | | |

^ pins must be connected together externally

## NSN GUIDE

| MCL NO. | NSN |
|---|---|
| RAY-1 | 5895-01-105-6188 |
| RAY-2 | 5895-01-111-7368 |
| RAY-3 | 5895-01-064-5082 |
| RAY-6 | 5895-01-317-5882 |
| SAY-11 | 5895-01-199-3893 |
| VAY-1 | 5895-01-232-5890 |
| ZMY-1B | 5895-01-213-3888 |
| ZMY-2 | 4935-01-080-7636 |

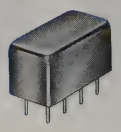
*units are not QPL listed

CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

## LEVEL 27 0.5 to 500 MHz



VAY

+27 dBm LO, up to +24 dBm RF

| MODEL NO. | FREQUENCY MHz LO/RF $f_L$-$f_U$ | FREQUENCY MHz IF | CONVERSION LOSS dB Mid-Band m $\bar{x}$ | m σ | m Max. | Total Range Max. | LO-RF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | LO-IF ISOLATION, dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VAY-1 | 0.5-500 | .02-500 | 5.79 | .15 | 7.5 | 8.5 | 47 | 40 | 46 | 35 | 35 | 25 | 35 | 28 | 46 | 35 | 35 | 25 | 1-190 | A01 | m | 84.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)
m = mid band (2$f_L$ to $f_U$/2)

NOTES:

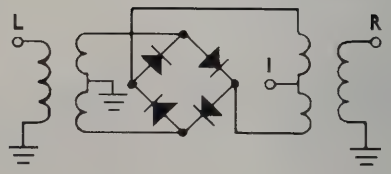
$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L$+$f_U$/4)
σ Standard deviation
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Level 27 mixers, RF power 500mW
   1b. Peak IF current, 40mA

### pin and coaxial connections

see case style outline drawings

| PORT | m |
|---|---|
| [illegible] | 8 |
| [illegible] | 1 |
| | 3 |
| GND EXT. | 2,5,6,7 |
| CASE GND | 2,5,6,7 |
| NOT USED | 4 |

^ pins must be connected together externally






Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# return loss Vs. VSWR

## table of return loss vs. voltage standing wave ratio

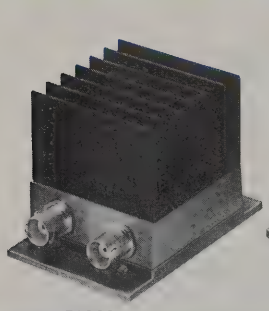
| RETURN LOSS (dB) | VSWR | RETURN LOSS (dB) | VSWR | RETURN LOSS (dB) | VSWR | RETURN LOSS (dB) | VSWR | RETURN LOSS (dB) | VSWR |
|---|---|---|---|---|---|---|---|---|---|
| 46.064 | 1.01 | 13.842 | 1.51 | 9.485 | 2.01 | 7.327 | 2.51 | 5.999 | 3.01 |
| 40.086 | 1.02 | 13.708 | 1.52 | 9.428 | 2.02 | 7.294 | 2.52 | 5.970 | 3.02 |
| 36.607 | 1.03 | 13.577 | 1.53 | 9.372 | 2.03 | 7.262 | 2.53 | 5.956 | 3.03 |
| 34.151 | 1.04 | 13.449 | 1.54 | 9.317 | 2.04 | 7.230 | 2.54 | 5.935 | 3.04 |
| 32.256 | 1.05 | 13.324 | 1.55 | 9.262 | 2.05 | 7.198 | 2.55 | 5.914 | 3.05 |
| 30.714 | 1.06 | 13.201 | 1.56 | 9.208 | 2.06 | 7.167 | 2.56 | 5.893 | 3.06 |
| 29.417 | 1.07 | 13.081 | 1.57 | 9.155 | 2.07 | 7.135 | 2.57 | 5.872 | 3.07 |
| 28.299 | 1.08 | 12.964 | 1.58 | 9.103 | 2.08 | 7.105 | 2.58 | 5.852 | 3.08 |
| 27.318 | 1.09 | 12.849 | 1.59 | 9.051 | 2.09 | 7.074 | 2.59 | 5.832 | 3.09 |
| 26.444 | 1.10 | 12.736 | 1.60 | 8.999 | 2.10 | 7.044 | 2.60 | 5.811 | 3.10 |
| 25.658 | 1.11 | 12.625 | 1.61 | 8.949 | 2.11 | 7.014 | 2.61 | 5.791 | 3.11 |
| 24.943 | 1.12 | 12.518 | 1.62 | 8.899 | 2.12 | 6.984 | 2.62 | 5.771 | 3.12 |
| 24.289 | 1.13 | 12.412 | 1.63 | 8.849 | 2.13 | 6.954 | 2.63 | 5.751 | 3.13 |
| 23.686 | 1.14 | 12.308 | 1.64 | 8.800 | 2.14 | 6.925 | 2.64 | 5.732 | 3.14 |
| 23.127 | 1.15 | 12.207 | 1.65 | 8.752 | 2.15 | 6.896 | 2.65 | 5.712 | 3.15 |
| 22.607 | 1.16 | 12.107 | 1.66 | 8.705 | 2.16 | 6.867 | 2.66 | 5.693 | 3.16 |
| 22.120 | 1.17 | 12.009 | 1.67 | 8.657 | 2.17 | 6.839 | 2.67 | 5.674 | 3.17 |
| 21.664 | 1.18 | 11.913 | 1.68 | 8.611 | 2.18 | 6.811 | 2.68 | 5.654 | 3.18 |
| 21.234 | 1.19 | 11.818 | 1.69 | 8.565 | 2.19 | 6.783 | 2.69 | 5.635 | 3.19 |
| 20.828 | 1.20 | 11.725 | 1.70 | 8.519 | 2.20 | 6.755 | 2.70 | 5.617 | 3.20 |
| 20.443 | 1.21 | 11.634 | 1.71 | 8.474 | 2.21 | 6.728 | 2.71 | 5.598 | 3.21 |
| 20.079 | 1.22 | 11.545 | 1.72 | 8.430 | 2.22 | 6.700 | 2.72 | 5.579 | 3.22 |
| 19.732 | 1.23 | 11.457 | 1.73 | 8.386 | 2.23 | 6.673 | 2.73 | 5.561 | 3.23 |
| 19.401 | 1.24 | 11.370 | 1.74 | 8.342 | 2.24 | 6.646 | 2.74 | 5.542 | 3.24 |
| 19.085 | 1.25 | 11.285 | 1.75 | 8.299 | 2.25 | 6.620 | 2.75 | 5.524 | 3.25 |
| 18.783 | 1.26 | 11.202 | 1.76 | 8.257 | 2.26 | 6.594 | 2.76 | 5.506 | 3.26 |
| 18.493 | 1.27 | 11.120 | 1.77 | 8.215 | 2.27 | 6.567 | 2.77 | 5.488 | 3.27 |
| 18.216 | 1.28 | 11.039 | 1.78 | 8.173 | 2.28 | 6.541 | 2.78 | 5.470 | 3.28 |
| 17.949 | 1.29 | 10.960 | 1.79 | 8.138 | 2.29 | 6.516 | 2.79 | 5.452 | 3.29 |
| 17.690 | 1.30 | 10.881 | 1.80 | 8.091 | 2.30 | 6.490 | 2.80 | 5.435 | 3.30 |
| 17.445 | 1.31 | 10.804 | 1.81 | 8.051 | 2.31 | 6.465 | 2.81 | 5.417 | 3.31 |
| 17.207 | 1.32 | 10.729 | 1.82 | 8.011 | 2.32 | 6.440 | 2.82 | 5.400 | 3.32 |
| 16.977 | 1.33 | 10.654 | 1.83 | 7.972 | 2.33 | 6.415 | 2.83 | 5.383 | 3.33 |
| 16.755 | 1.34 | 10.581 | 1.84 | 7.933 | 2.34 | 6.390 | 2.84 | 5.365 | 3.34 |
| 16.540 | 1.35 | 10.509 | 1.85 | 7.894 | 2.35 | 6.366 | 2.85 | 5.348 | 3.35 |
| 16.332 | 1.36 | 10.437 | 1.86 | 7.856 | 2.36 | 6.341 | 2.86 | 5.331 | 3.36 |
| 16.131 | 1.37 | 10.367 | 1.87 | 7.818 | 2.37 | 6.317 | 2.87 | 5.315 | 3.37 |
| 15.936 | 1.38 | 10.298 | 1.88 | 7.781 | 2.38 | 6.293 | 2.88 | 5.298 | 3.38 |
| 15.747 | 1.39 | 10.230 | 1.89 | 7.744 | 2.39 | 6.270 | 2.89 | 5.281 | 3.39 |
| 15.563 | 1.40 | 10.163 | 1.90 | 7.707 | 2.40 | 6.246 | 2.90 | 5.265 | 3.40 |
| 15.385 | 1.41 | 10.097 | 1.91 | 7.671 | 2.41 | 6.223 | 2.91 | 5.248 | 3.41 |
| 15.211 | 1.42 | 10.032 | 1.92 | 7.635 | 2.42 | 6.200 | 2.92 | 5.232 | 3.42 |
| 15.043 | 1.43 | 9.968 | 1.93 | 7.599 | 2.43 | 6.177 | 2.93 | 5.216 | 3.43 |
| 14.879 | 1.44 | 9.904 | 1.94 | 7.564 | 2.44 | 6.154 | 2.94 | 5.200 | 3.44 |
| 14.719 | 1.45 | 9.842 | 1.95 | 7.529 | 2.45 | 6.131 | 2.95 | 5.184 | 3.45 |
| 14.564 | 1.46 | 9.780 | 1.96 | 7.494 | 2.46 | 6.109 | 2.96 | 5.168 | 3.46 |
| 14.412 | 1.47 | 9.720 | 1.97 | 7.460 | 2.47 | 6.086 | 2.97 | 5.152 | 3.47 |
| 14.264 | 1.48 | 9.660 | 1.98 | 7.426 | 2.48 | 6.064 | 2.98 | 5.137 | 3.48 |
| 14.120 | 1.49 | 9.601 | 1.99 | 7.393 | 2.49 | 6.042 | 2.99 | 5.121 | 3.49 |
| 13.979 | 1.50 | 9.542 | 2.00 | 7.360 | 2.50 | 6.021 | 3.00 | 5.105 | 3.50 |

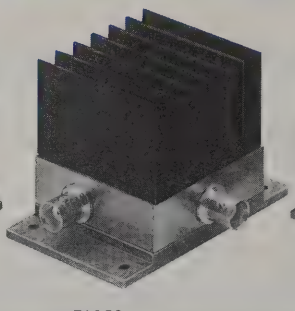
In Stock... Immediate Delivery

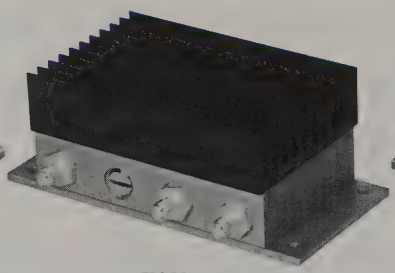
For Custom Versions Of Standard Models Consult Our Applications Dept.

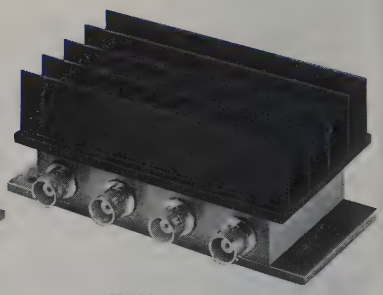
# HIGH POWER COMBINERS/SPLITTERS

## 2,3 and 4 WAY 2 MHz to 2 GHz


ZA2CS


ZA3CS


ZB3CS


ZB4CS

| | MODEL NO. | No. of WAYS | FREQ. MHz $f_L$ $f_U$ | ISOLATION dB Typ. | ISOLATION dB Min. | INSERTION LOSS+ dB (above theoretical) Typ. | INSERTION LOSS+ dB (above theoretical) Max. | PHASE UNBALANCE Degrees Typ. | PHASE UNBALANCE Degrees Max. | AMPLITUDE UNBALANCE dB Typ. | AMPLITUDE UNBALANCE dB Max. | POWER INPUT, W[1] as Combiner[2] Max. | POWER INPUT, W[1] as Splitter Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ZA2CS-500-15W | 2 | 200-500 | 31 | 20 | 0.3 | 1.0 | 0.3 | 3.0 | 0.10 | 0.4 | 15 | 15 | — | AW254 | — | 74.95 |
| | ZA2CS-600-10W | 2 | 100-600 | 27 | 15 | 0.4 | 1.3 | 0.4 | 3.0 | 0.15 | 0.5 | 10 | 10 | — | AW254 | — | 74.95 |
| NEW △ | ZA2CS-2G-20W | 2 | 1800-2000 | 30 | 20 | 0.2 | 0.5 | 0.5 | 4.0 | 0.05 | 0.2 | 20 | 20 | — | AW254 | — | 89.95 |
| | ZA3CS-400-3W* | 3 | 2-400 | 25 | 17 | 0.5 | 1.2 | 0.2 | 3.0 | 0.15 | 0.5 | 3 | 10 | — | CC258 | — | 59.95 |
| | ZA3CS-450-9W | 3 | 100-450 | 22 | 15 | 0.9 | 1.8 | 2.5 | 8.0 | 0.20 | 0.7 | 9 | 12 | — | AX255 | — | 99.95 |
| NEW △ | ZB3CS-920-15W | 3 | 825-920 | 27 | 17 | 0.2 | 0.8 | 1.7 | 6.0 | 0.11 | 0.5 | 15 | 15 | — | AW256 | — | 114.95 |
| | ZB4CS-440-12W | 4 | 100-440 | 27 | 17 | 0.6 | 1.2 | 0.8 | 4.0 | 0.15 | 0.5 | 12 | 10 | — | AW256 | — | 134.95 |
| NEW △ | ZB4CS-960-12W | 4 | 820-960 | 28 | 17 | 0.3 | 0.8 | 2.0 | 6.0 | 0.2 | 0.6 | 12 | 12 | — | AW256 | — | 134.95 |

### features

- low insertion loss
- very low amplitude unbalance
- low phase unbalance
- as a combiner, ideal for VHF transmitter applications
- cellular applications

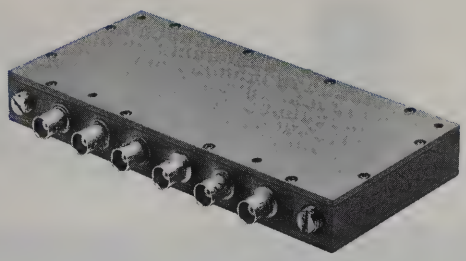
+Theoretical Insertion Loss

2-Way ..... 3.0 dB
3-Way ..... 4.8 dB
4-Way ..... 6.0 dB
6-Way ..... 7.8 dB
8-Way ..... 9.0 dB

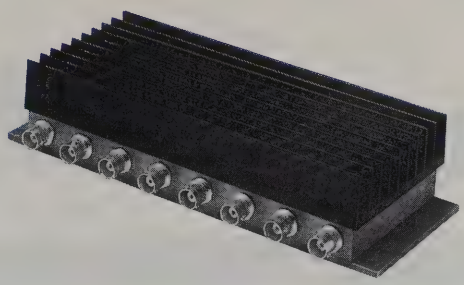


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 6 AND 8 WAY 50 MHz to 950 MHz



ZB6CS



ZB8CS

| MODEL NO. | No. of WAYS | FREQ. MHz $f_L$ $f_U$ | ISOLATION dB Typ. | ISOLATION dB Min. | INSERTION LOSS÷ dB (above theoretical) Typ. | INSERTION LOSS÷ dB (above theoretical) Max. | PHASE UNBALANCE Degrees Typ. | PHASE UNBALANCE Degrees Max. | AMPLITUDE UNBALANCE dB Typ. | AMPLITUDE UNBALANCE dB Max. | POWER INPUT, W[1] as Combiner[2] Max. | POWER INPUT, W[1] as Splitter Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZB6CS-150-12W | 6 | 50-150 | 32 | 20 | 0.5 | 1.2 | 3.0 | 9.0 | 0.15 | 0.5 | 12 | 10 | -- | Z259 | -- | 159.95 |
| ZB8CS-950-32W | 8 | 800-950 | 30 | 18 | 0.4 | 1.0 | 2.0 | 6.0 | 0.10 | 0.5 | 32 | 32 | -- | AW257 | -- | 199.95 |

NOTES:

△ Available only with SMA connectors

A. General Quality Control Procedures, Environmental Specifications are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted option, case finishes are given in section 0, see "Case styles & Outline drawings".

C. Prices and Specifications subject to change without notice.

* Photo for ZA3CS-400-3W not shown. See outline drawing CC258.

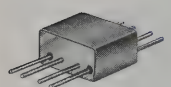
1. Over -55°C to +55°C. Derate linearly to 20% of rating at 90°C.
2. As a combiner of noncoherent signals, max. power per port is power rating divided by number of ports.
3. Operating temperature: -55°C to 90°C
   Storage temperature: -55°C to 100°C

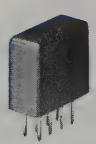
CAPD now available! computer-automated performance data

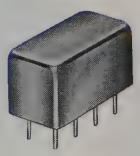
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

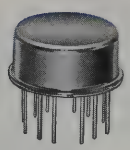
## 2 WAY-0° 4 kHz to 2.5 GHz

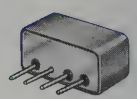

LPS


MSC


PSC

TO5SC


TO8SC


TSC

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB L Min. | ISOLATION dB M° Typ. | ISOLATION dB M° Min. | ISOLATION dB U Typ. | ISOLATION dB U Min. | INSERTION LOSS, dB Above 3dB L Typ. | INSERTION LOSS, dB Above 3dB L Max. | INSERTION LOSS, dB Above 3dB M° Typ. | INSERTION LOSS, dB Above 3dB M° Max. | INSERTION LOSS, dB Above 3dB U Typ. | INSERTION LOSS, dB Above 3dB U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LPS-109 | 10-500 | 35 | 25 | 30 | 25 | 30 | 25 | 0.3 | 0.5 | 0.4 | 0.6 | 0.5 | 1.1 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.3 | 2-84 | BB48 | an | 17.95 |
| | MSC-2-1 | 0.1-450 | 20 | 15 | 30 | 20 | 30 | 20 | 0.3 | 0.5 | 0.4 | 0.75 | 0.6 | 1.0 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.3 | 2-89 | A03 | ap | 18.95 |
| | MSC-2-1W | 2-650 | 22 | 18 | 30 | 20 | 22 | 18 | 0.3 | 0.5 | 0.5 | 0.8 | 0.8 | 1.2 | 1.0 | 2.0 | 4.0 | 0.3 | 0.2 | 0.3 | 2-89 | A03 | ap | 20.95 |
| | MSC-2-5 | 5-1500 | 18 | 16 | 20 | 16 | 20 | 14 | 0.6 | 0.8 | 0.6 | 0.8 | 0.6 | 1.1 | 2.0 | 3.0 | 5.0 | 0.2 | 0.3 | 0.4 | 2-29 | A03 | ap | 24.95 |
| | MSC-2-11 | 5-2000 | 18 | 16 | 20 | 16 | 18 | 11 | 0.6 | 0.8 | 0.6 | 0.8 | 1.2 | 1.8 | 2.0 | 3.0 | 5.0 | 0.2 | 0.3 | 0.5 | 2-94 | A03 | ap | 29.95 |
| | PSC-2-1 | 0.1-400 | 20 | 15 | 25 | 20 | 25 | 20 | 0.2 | 0.6 | 0.4 | 0.75 | 0.6 | 1.0 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.3 | 2-84 | A01 | ap | 10.95 |
| | PSC-2-1W | 1-650 | 25 | 20 | 35 | 20 | 25 | 20 | 0.3 | 0.6 | 0.5 | 0.9 | 0.7 | 1.0 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.3 | 2-85 | A01 | ap | 16.95 |
| ✣ | PSC-2-2 | 0.004-60 | 27 | 20 | 30 | 20 | 27 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.6 | 1.0 | 2.0 | 3.0 | 4.0 | 0.15 | 0.25 | 0.3 | 2-85 | A01 | ap | 23.95 |
| | PSC-2-4 | 10-1000 | 30 | 25 | 25 | 20 | 25 | 20 | 0.6 | 1.0 | 0.6 | 1.2 | 0.7 | 1.3 | 2.0 | 4.0 | 8.0 | 0.15 | 0.2 | 0.4 | 2-86 | A01 | ap | 23.95 |
| | PSC-2-5 | 10-1400 | 28 | 18 | 22 | 17 | 24 | 17 | 0.3 | 0.6 | 0.6 | 1.0 | 0.9 | 1.6 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.4 | 2-29 | A01 | ap | 29.95 |
| | PSC-2-11 | 5-2000 | 21 | 16 | 22 | 18 | 19 | 9 | 0.5 | 0.8 | 0.6 | 0.9 | 0.7 | 1.5 | 1.0 | 3.0 | 6.0 | 0.20 | 0.4 | 1.0 | — | A01 | ap | 34.95 |
| | PSC-2-45 | 700-900 | | | 20 | 17 | | | | | 0.2 | 0.4 | | | | 3.0 | | | 0.2 | | 2-86 | A01 | ap | 22.95 |
| | PSC-2-1000 | 400-1000 | | | 35 | 25 | | | | | 0.5 | 1.0 | | | | 2.0 | | | 0.3 | | — | A06 | ap | 22.95 |
| ■ | PSC-2-1-75 | 0.25-300 | 20 | 15 | 30 | 20 | 20 | 15 | 0.4 | 0.75 | 0.4 | 0.75 | 0.4 | 1.0 | 2.0 | 3.0 | 5.0 | 0.15 | 0.2 | 0.3 | 2-87 | A01 | ap | 13.45 |
| ■ | PSC-2-1-75A* | 1-200 | 35 | 27 | 46 | 35 | 36 | 25 | 0.1 | 0.3 | 0.2 | 0.4 | 0.35 | 0.6 | 1.0 | 1.0 | 2.0 | 0.1 | 0.15 | 0.15 | 2-97 | A06 | ap | 14.45 |
| ■ | PSC-2-1V-75 | 40-450 | | | 31 | 27 | | | | | 0.5 | 1.0 | | | | 4.0 | | | 0.3 | | 2-96 | A01 | ap | 14.45 |
| ■ | PSC-2-1W-75** | 30-600 | 30 | 22 | — | — | 30 | 20 | 0.4 | 0.8 | — | — | 0.6 | 1.2 | 2.0 | — | 4.0 | 0.2 | — | 0.3 | 2-97 | A06 | ap | 18.95 |
| ✣■ | PSC-2-2-75 | 0.008-60 | 35 | 20 | 40 | 25 | 30 | 22 | 0.1 | 0.4 | 0.15 | 0.4 | 0.3 | 0.8 | 1.0 | 1.0 | 1.0 | 0.15 | 0.15 | 0.15 | 2-96 | A01 | ap | 23.95 |
| ■ | PSC-2-4-752 | 10-850 | 31 | 20 | 32 | 23 | 23 | 15 | 0.3 | 0.5 | 0.4 | 0.6 | 0.5 | 1.0 | 2.0 | 5.0 | 10.0 | 0.1 | 0.2 | 0.5 | 2-88 | A01 | ap | 23.95 |
| ■ | PSC-2375 | 55-85 | | | 35 | 25 | | | | | 0.3 | 0.5 | | | | 1.0 | | | 0.1 | | 2-87 | A01 | ap | 23.95 |
| | PSC-2-500-1W | 225-500 | | | 27 | 20 | | | | | 0.2 | 0.6 | | | | 2.0 | | | 0.2 | | — | A01 | ap | 21.95 |
| | PSC-2-960-1W | 300-960 | | | 27 | 20 | | | | | 0.5 | 1.2 | | | | 3.0 | | | 0.4 | | -- | A01 | ap | 25.95 |
| | TO5SC-110 | 5-500 | 36 | 20 | 40 | 25 | 36 | 20 | 0.3 | 0.6 | 0.3 | 0.7 | 0.6 | 1.0 | 1.0 | 2.0 | 2.0 | 0.10 | 0.20 | 0.2 | — | PP163 | ak | 19.95 |
| | TO5SC-2-1 | 1-500 | 30 | 20 | 28 | 20 | 26 | 20 | 0.2 | 0.5 | 0.3 | 0.7 | 0.7 | 1.5 | 2.0 | 1.0 | 2.5 | 0.25 | 0.25 | 0.4 | 2-95 | PP163 | ak | 18.95 |
| | TO8SC-2-11 | 1150-1750 | | | 30 | 18 | | | | | 0.4 | 0.9 | | | | 6.0 | | | 0.5 | | — | QQ96 | he | 32.95 |
| | TSC-2-1 | 1-400 | 30 | 25 | 30 | 25 | 30 | 20 | 0.25 | 0.5 | 0.4 | 0.75 | 0.8 | 1.0 | 2.0 | 3.0 | 4.0 | 0.15 | 0.2 | 0.6 | 2-90 | B02 | aj | 15.95 |
| | | | L2 | | U2 | | | | L2 | | U2 | | | | L2 | U2 | | L2 | U2 | | | | | |
| NEW | TSC-2-1W | 200-1000 | 26 | 20 | 23 | 14 | | | 0.3 | 0.8 | 0.7 | 1.5 | | | 5 | 10 | | 0.7 | 0.5 | | -- | B02 | aj | 19.95 |

L = low range ($f_L$ to 10 $f_L$)
$L_2$ = ($f_L$ to $f_U$/2)

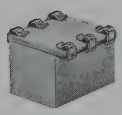
M = mid range (10 $f_L$ to $f_U$/2)
$U_2$ = ($f_U$/2 to $f_U$)

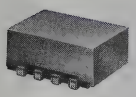
U = upper range ($f_U$/2 to $f_U$)

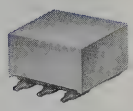
NOTES:

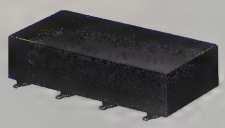
❑ Non-hermetic
✪ When only specification for M range given, specification applies to entire frequency range.
✣ At low range frequency band ($f_L$ to 10 $f_L$), linearly derate maximum input power by 13 dB.
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
* VSWR typical 1.1:1 over total range of frequency, max 1.2:1 for low and upper range, max 1.15:1 for mid range.
** VSWR low range 1.1:1 typical, 1.3:1 max; upper range 1.15:1 typical, 1.25:1 max.

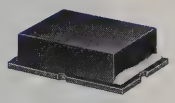
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating, 1 Watt except JYPS-2-4-75, PSC-2-11, 0.5 Watt
   1b. Internal load dissipation, 0.125 Watt except PSC-2-500-1W, PSC-2-960-1W, 0.5 Watt


JPS


JYPS


LRPS


SCP


SYPS

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB L Min. | ISOLATION dB M° Typ. | ISOLATION dB M° Min. | ISOLATION dB U Typ. | ISOLATION dB U Min. | INSERTION LOSS, dB Above 3dB L Typ. | INSERTION LOSS, dB Above 3dB L Max. | INSERTION LOSS, dB Above 3dB M° Typ. | INSERTION LOSS, dB Above 3dB M° Max. | INSERTION LOSS, dB Above 3dB U Typ. | INSERTION LOSS, dB Above 3dB U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | JPS-2-1N | 350-550 | | | 30 | 20 | | | | | 0.25 | 0.5 | | | | 3.0 | | | 0.3 | | — | BH292 | hv | 8.95 |
| | JPS-2-1W | 3-750 | 36 | 20 | 28 | 17 | 19 | 16 | 0.5 | 0.8 | 0.4 | 1.0 | 0.9 | 1.4 | 1.0 | 2.0 | 4.0 | 0.2 | 0.3 | 0.4 | — | BH292 | hv | 8.95 |
| NEW | JPS-2-4 | 100-1000 | | | 22 | 16 | | | | | 0.5 | 1.4 | | | | 5.0 | | | 0.4 | | — | BH292 | hv | 9.95 |
| NEW | JPS-2-900 | 400-900 | | | 24 | 18 | | | | | 0.5 | 1.2 | | | | 3.0 | | | 0.4 | | — | BH292 | hv | 9.95 |
| NEW ■ | JYPS-2-4-75 | 5-1000 | 24 | 17 | 25 | 20 | 30 | 18 | 0.4 | 0.8 | 0.4 | 1.0 | 0.8 | 1.5 | 3.0 | 4.0 | 5.0 | 0.2 | 0.3 | 0.4 | — | BJ293 | jf | 16.95 |
| | LRPS-2-1 | 5-500 | 50 | 25 | 33 | 24 | 30 | 23 | 0.25 | 0.5 | 0.3 | 0.6 | 0.5 | 1.2 | 1.0 | 2.0 | 3.0 | 0.15 | 0.2 | 0.3 | 2-118 | QQQ130 | am | 8.95 |
| ■ | LRPS-2-1-75 | 2-500 | 35 | 18 | 35 | 25 | 27 | 20 | 0.30 | 0.8 | 0.35 | 0.6 | 0.5 | 1.0 | 1.0 | 2.0 | 3.0 | 0.15 | 0.2 | 0.3 | — | QQQ130 | am | 8.95 |
| ■ | LRPS-2-1W-75 | 10-650 | 28 | 22 | 29 | 24 | 30 | 20 | 0.5 | 1.0 | 0.6 | 0.75 | 0.6 | 1.2 | 1.0 | 2.0 | 3.0 | 0.15 | 0.2 | 0.3 | — | QQQ130 | am | 9.95 |
| | LRPS-2-4 | 10-1000 | 25 | 20 | 23 | 16 | 19 | 14 | 0.3 | 0.5 | 0.4 | 0.9 | 0.8 | 1.5 | 1.0 | 3.0 | 5.0 | 0.15 | 0.2 | 0.4 | 2-120 | QQQ130 | am | 19.95 |
| | LRPS-2-11 | 20-2000 | 19 | 15 | 21 | 15 | 30 | 15 | 0.6 | 0.8 | 0.7 | 1.0 | 0.8 | 1.5 | 2.0 | 3.0 | 5.0 | 0.2 | 0.3 | 0.7 | — | QQQ130 | gn | 24.95 |
| | LRPS-2-25 | 1700-2500 | | | 20 | 16 | | | | | 0.8 | 1.3 | | | | 10.0 | | | 0.9 | | — | QQQ130 | gn | 21.95 |
| | LRPS-2-980 | 800-980 | | | 30 | 18 | | | | | 0.5 | 1.0 | | | | 3.0 | | | 0.5 | | — | QQQ130 | am | 8.95 |
| | SCP-2-1 | 0.1-400 | 25 | 15 | 30 | 20 | 25 | 20 | 0.3 | 1.2 | 0.2 | 0.6 | 0.4 | 1.1 | 2.0 | 2.0 | 3.0 | 0.15 | 0.2 | 0.3 | 2-92 | YY101 | aq | 10.45 |
| | SCP-2-1A | 1-550 | 25 | 20 | 25 | 20 | 25 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.7 | 1.3 | 2.0 | 2.0 | 3.0 | 0.15 | 0.2 | 0.4 | 2-92 | YY101 | aq | 10.45 |
| | SYPS-2-1 | 2-500 | 40 | 20 | 32 | 20 | 30 | 20 | 0.2 | 0.6 | 0.3 | 0.75 | 0.6 | 1.0 | 2.0 | 3.0 | 4.0 | 0.2 | 0.3 | 0.5 | | TTT167 | hk | 12.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

**NSN GUIDE**

| MCL NO. | NSN | MIL-P-23971/15* |
|---|---|---|
| MSC-2-1 | 6625-01-124-8595 | 02 |
| PSC-2-1 | 6625-00-548-0739 | 01 |
| PSC-2-1W | 5985-01-190-7701 | |
| PSC-2-2 | 6625-01-143-2571 | |
| PSC-2-4 | 6625-01-230-0492 | |
| TSC-2-1 | 5895-01-332-8100 | |

* units are not QPL listed

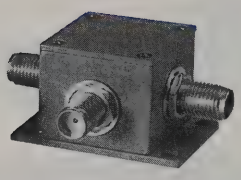
## pin connections see case style outline drawings for pin locations

| PORT | aj | ak | am | an | ap | aq | gn | he | hk | hv | jf |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SUM PORT | 1 | 2 | 6 | 1 | 1 | 1 | 6 | 5 | 1 | 1 | 1 |
| PORT 1 | 2 | 1 | 4 | 4 | 5 | 5 | 4 | 9 | 3 | 3 | 3 |
| PORT 2 | 4 | 3 | 3 | 5 | 6 | 6 | 3 | 1 | 2 | 4 | 6 |
| GND EXT. | 3 | 4,5 | 1 | 2,3,6,7,8 | 2,3,4,7,8 | 2,3,4,7,8 | 1,2,5 | all other pins | 4,5,6 | 6 | 7,8 |
| CASE GND | 3 | 4,5 | — | 2,3,6,7,8 | 2,3,4,7,8 | — | — | all other pins | — | — | — |
| NOT USED | | | 2,5 | | — | — | — | | — | 2,5 | 2,4,5 |

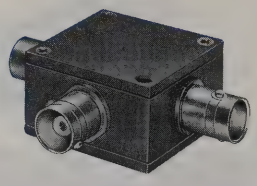
In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.
Available Tape & Reel

# POWER SPLITTERS/COMBINERS 50 & 75Ω

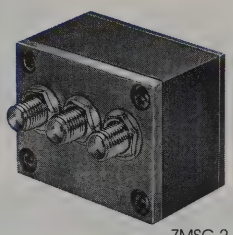
## 2 WAY-0° 2 kHz to 10 GHz



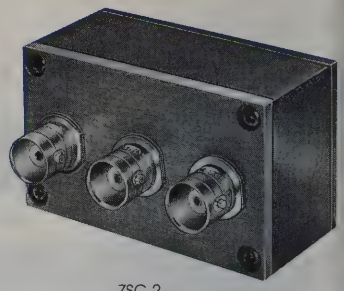
ZESC-2



ZFSC-2



ZMSC-2



ZSC-2

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M° Typ. | M° Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 3dB L Typ. | L Max. | M° Typ. | M° Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M° Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M° Max. | U Max. | VSWR (:1) S Typ. | S Max. | OUT Typ. | OUT Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ZESC-2-11 | 10-2000 | 19 | 10 | 18 | 13 | 20 | 11 | 0.5 | 0.9 | 0.5 | 1.0 | 0.6 | 1.2 | 1 | 3 | 6 | 0.20 | 0.30 | 0.50 | | | | | 2-94 | V37 | ar | 71.95 |
| | ZFSC-2-1 | 5-500 | 30 | 25 | 28 | 20 | 25 | 20 | 0.2 | 0.5 | 0.3 | 0.6 | 0.6 | 0.8 | 2 | 4 | 4 | 0.15 | 0.15 | 0.30 | | | | | 2-91 | K18 | ar | 44.95 |
| ■ | ZFSC-2-1-75 | 0.25-300 | 20 | 15 | 30 | 25 | 25 | 20 | 0.4 | 0.75 | 0.4 | 0.75 | 0.4 | 1.0 | 2 | 3 | 5 | 0.15 | 0.20 | 0.30 | | | | | 2-91 | K18 | ar | 45.95 |
| ■ | ZFSC-2-1W-75 | 5-600 | 44 | 26 | 45 | 30 | 31 | 20 | 0.22 | 0.6 | 0.27 | 0.7 | 0.46 | 0.9 | 1 | 2 | 3 | 0.20 | 0.30 | 0.40 | | | | | — | K18 | ar | 50.95 |
| | ZFSC-2-1W | 1-750 | 30 | 20 | 28 | 20 | 25 | 20 | 0.2 | 0.5 | 0.4 | 0.8 | 0.8 | 1.0 | 2 | 4 | 4 | 0.15 | 0.15 | 0.30 | | | | | 2-28 | K18 | ar | 48.95 |
| | ZFSC-2-2 | 10-1000 | 30 | 20 | 25 | 20 | 23 | 18 | 0.2 | 0.5 | 0.5 | 1.0 | 0.9 | 1.2 | 2 | 4 | 4 | 0.15 | 0.15 | 0.30 | | | | | 2-28 | K18 | ar | 51.95 |
| | | GHz | L1 | U1 | | | | | L1 | | U1 | | | | L1 | U1 | | L1 | U1 | | | | | | | | | |
| | ZFSC-2-9G | 3.5-9.0 | 18 | 12 | 20 | 12 | | | 0.5 | 1.5 | 0.6 | 1.2 | | | 7 | 10 | | 0.30 | 0.50 | | | | | | 2-93 | JJJ142 | as | 59.95 |
| | ZFSC-2-10G | 2.0-10.0 | 15 | 9 | 20 | 12 | | | 0.5 | 1.5 | 0.6 | 1.6 | | | 7 | 12 | | 0.60 | 0.50 | | | | | | 2-93 | JJJ142 | as | 69.95 |
| | ZFSC-2-4 | 0.2-1000 | 20 | 15 | 25 | 20 | 23 | 18 | 0.2 | 0.5 | 0.5 | 1.0 | 0.9 | 1.2 | 2 | 4 | 4 | 0.15 | 0.15 | 0.30 | see | | | | 2-29 | K18 | ar | 55.95 |
| | ZFSC-2-5 | 10-1500 | 25 | 15 | 30 | 20 | 25 | 18 | 0.25 | 0.6 | 0.5 | 1.0 | 0.8 | 1.5 | 2 | 3 | 4 | 0.15 | 0.20 | 0.50 | Performance | | | | 2-29 | K18 | ar | 59.95 |
| ✣ | ZFSC-2-6* | 0.002-60 | 27 | 20 | 30 | 20 | 27 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.20 | 0.30 | | | | | 2-30 | K18 | ar | 49.95 |
| ✣■ | ZFSC-2-6-75 | 0.004-60 | 30 | 20 | 35 | 20 | 25 | 20 | 0.5 | 0.8 | 0.4 | 0.8 | 0.7 | 1.0 | 1 | 2 | 3 | 0.15 | 0.20 | 0.30 | Data and | | | | 2-30 | K18 | ar | 51.95 |
| NEW | ZFSC-2-11 | 10-2000 | 14 | 10 | 16 | 14 | 20 | 15 | 1.2 | 1.5 | 1.2 | 1.5 | 1.0 | 2.2 | 1 | 2 | 4 | 0.20 | 0.30 | 0.50 | | | | | 2-94 | K18 | ar | 64.95 |
| △ | ZFSC-2-2500 | 10-2500 | 16 | 11 | 17 | 14 | 17 | 14 | 0.5 | 0.8 | 0.6 | 1.4 | 0.8 | 1.5 | 1 | 4 | 8 | 0.20 | 0.30 | 0.40 | curves | | | | 2-94 | K18 | ar | 74.95 |
| | ZMSC-2-1 | 0.1-400 | 20 | 15 | 25 | 20 | 25 | 20 | 0.2 | 0.5 | 0.4 | 0.75 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.20 | 0.30 | | | | | 2-32 | M21 | at | 49.95 |
| | ZMSC-2-1W | 1-650 | 25 | 20 | 35 | 20 | 25 | 20 | 0.3 | 0.5 | 0.5 | 0.8 | 0.7 | 1.0 | 2 | 3 | 4 | 0.15 | 0.20 | 0.30 | | | | | 2-32 | M21 | at | 54.95 |
| ✣ | ZMSC-2-2* | 0.002-60 | 27 | 20 | 30 | 20 | 27 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.25 | 0.30 | | | | | 2-43 | M21 | at | 59.95 |
| | ZSC-2-1 | 0.1-400 | 20 | 15 | 25 | 20 | 25 | 20 | 0.2 | 0.5 | 0.4 | 0.75 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.20 | 0.30 | | | | | 2-32 | M22 | at | 47.95 |
| | ZSC-2-1W | 1-650 | 25 | 20 | 35 | 25 | 25 | 20 | 0.3 | 0.5 | 0.5 | 0.8 | 0.7 | 1.0 | 2 | 3 | 4 | 0.15 | 0.20 | 0.30 | | | | | 2-32 | M22 | at | 49.95 |
| ✣ | ZSC-2-2* | 0.002-60 | 25 | 20 | 30 | 20 | 27 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.25 | 0.30 | | | | | 2-33 | M22 | at | 52.95 |
| ✣■ | ZSC-2-2-75* | 0.002-60 | 25 | 20 | 30 | 20 | 27 | 20 | 0.3 | 0.6 | 0.3 | 0.6 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.25 | 0.30 | | | | | 2-96 | M22 | at | 53.95 |
| | ZSC-2-4 | 10-1000 | 25 | 20 | 35 | 20 | 25 | 20 | 0.2 | 0.5 | 0.5 | 0.8 | 0.7 | 1.3 | 2 | 4 | 6 | 0.15 | 0.20 | 0.30 | | | | | 2-33 | M22 | at | 52.95 |
| ■ | ZSC-2375 | 55-85 | | | 35 | 25 | | | | | 0.3 | 0.5 | | | | 1 | | | 0.10 | | | | | | 2-31 | M22 | at | 52.95 |
| ■ | ZSC-2-1-75 | 0.25-300 | 20 | 15 | 30 | 20 | 20 | 15 | 0.4 | 0.75 | 0.4 | 0.75 | 0.4 | 1.0 | 2 | 3 | 5 | 0.15 | 0.20 | 0.30 | | | | | 2-31 | M22 | at | 49.95 |

NOTES:

* Isolation specified to 0.004 MHz

✪ When only specification for M range given, specification applies to entire frequency range.

✣ At low range frequency band (fL to 10 fL), linearly derate maximum input power by 13 dB.

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

△ Available only with SMA connectors

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating, models ZAPD, ZN2PD, ZC2PD 10 Watt
   other models 1 Watt
   1b. Internal load dissipation 0.125 Watt

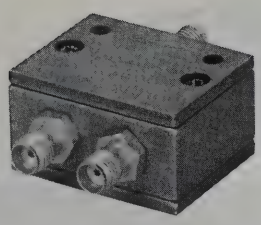
### coaxial connections

see case style outline drawing for pin locations

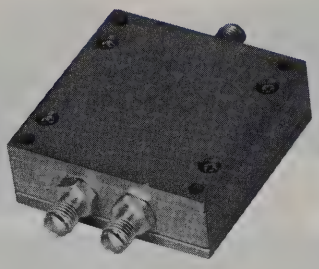
| PORT | ar | as | at |
|---|---|---|---|
| SUM PORT | 3 | S | 2 |
| PORT 1 | 1 | 1 | 1 |
| PORT 2 | 2 | 2 | 3 |
| GND EXT. | | | |
| CASE GND | | | |
| NOT USED | | | |



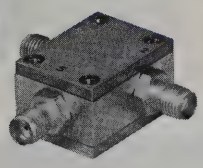
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



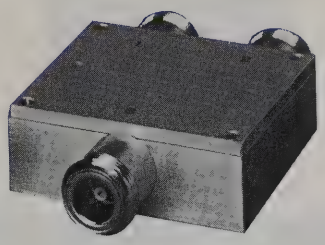
ZC2PD



ZN2PD



IZY2PD



ZAPD

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. Min. | ISOLATION dB M° Typ. Min. | ISOLATION dB U Typ. Min. | INSERTION LOSS, dB Above 3dB L Typ. Max. | INSERTION LOSS, dB Above 3dB M° Typ. Max. | INSERTION LOSS, dB Above 3dB U Typ. Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | VSWR (:1) S Typ. Max. | VSWR (:1) OUT Typ. Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZC2PD-900 | 800-900 | | 30 20 | | | 0.1 0.4 | | | 2 | | | 0.20 | | 1.10 1.30 | 1.10 1.30 | 2-109 | F183 | as | 64.95 |
| ZN2PD-920 | 800-920 | | 30 20 | | | 0.15 0.4 | | | 2 | | | 0.20 | | 1.10 1.20 | 1.04 1.20 | 2-108 | VVV180 | as | 59.95 |
| ZN2PD-920W | 700-1050 | | 22 15 | | | 0.15 0.5 | | | 3 | | | 0.30 | | 1.20 1.50 | 1.04 1.20 | 2-108 | VVV180 | as | 54.95 |
| ZN2PD-1900 | 1600-1900 | | 30 20 | | | 0.18 0.4 | | | 2 | | | 0.20 | | 1.20 1.35 | 1.04 1.20 | — | VVV180 | as | 69.95 |
| ZN2PD-1900W | 1500-2000 | | 24 15 | | | 0.2 0.5 | | | 3 | | | 0.30 | | 1.20 1.50 | 1.04 1.20 | — | VVV180 | as | 64.95 |
| | GHz | | | | | | | | | | | | | | | | | | |
| IZY2PD-64 | 5.8-6.4 | | 35 24 | | | 0.2 0.5 | | | 5 | | | 0.30 | | 1.05 1.30 | 1.20 1.35 | — | JJJ245 | as | 89.95 |
| IZY2PD-86 | 7.0-8.6 | | 30 18 | | | 0.1 0.5 | | | 6 | | | 0.25 | | 1.10 1.45 | 1.10 1.40 | — | JJJ245 | as | 94.95 |
| ZAPD-1 | 0.5-1.0 | | 25 19 | | | 0.25 0.6 | | | 2 | | | 0.20 | | see | | 2-34 | F14 | ar | 54.95 |
| ZAPD-2 | 1.0-2.0 | | 25 19 | | | 0.25 0.6 | | | 2 | | | 0.20 | | | | 2-34 | F14 | ar | 54.95 |
| ZAPD-21 | 0.5-2.0 | | 25 18 | | | 0.25 1.0 | | | 3 | | | 0.20 | | Performance | | 2-35 | F53 | ar | 59.95 |
| ZAPD-4 | 2.0-4.2 | | 25 19 | | | 0.4 0.8 | | | 6 | | | 0.40 | | Data and | | 2-35 | F14 | ar | 59.95 |
| ZAPD-50 | 4.4-5.0 | | 26 20 | | | 0.3 0.8 | | | 5 | | | 0.50 | | | | — | F14 | ar | 54.95 |
| ZAPD-50W | 4.2-6.0 | | 26 16 | | | 0.3 0.8 | | | 5 | | | 0.70 | | | | — | F14 | ar | 64.95 |
| W ZAPD-1750 | 0.95-1.75 | | 30 22 | | | 0.2 0.4 | | | 4 | | | 0.50 | | curves | | — | F14 | ar | 54.95 |

L = low range ($f_L$ to 10 $f_L$)
L1 = $f_L$ to 6 GHz

M = mid range (10 $f_L$ to $f_U$/2)
U1 = 6 GHz to $f_U$

U = upper range ($f_U$/2 to $f_U$)

## NSN GUIDE

| MCL NO. | NSN |
|---|---|
| ZAPD-1(TNC) | 5985-01-250-4883 |
| ZAPD-2(SMA) | 5895-01-229-7431 |
| ZAPD-4 | 6625-01-173-1887 |
| ZAPD-4(SMA) | 5985-01-383-0636 |
| ZESC-2-11 | 5985-01-381-9081 |
| ZFSC-2-1 | 6625-01-139-3499 |
| ZFSC-2-1(SMA) | 6625-01-213-6490 |
| ZFSC-2-1(BNC) | 5985-01-176-4551 |
| ZFSC-2-1-75 | 5895-01-325-4795 |
| ZFSC-2-1W(SMA) | 6625-01-200-5094 |
| ZFSC-2-1W | 5895-01-348-3534 |
| ZFSC-2-2B(SMA) | 6625-01-362-1801 |

| MCL NO. | NSN |
|---|---|
| ZFSC-2-2(SMA) | 6625-01-333-1127 |
| ZFSC-2-2B | 5895-01-330-4416 |
| ZFSC-2-4(TNC) | 5985-01-250-4882 |
| ZFSC-2-5 | 6625-01-253-2444 |
| ZFSC-2-6 | 6625-01-419-4241 |
| ZFSC-2-6(BNC) | 5895-01-408-6857 |
| ZFSC-2-6B | 5985-01-315-2869 |
| ZFSC-2-11(SMA) | 6625-01-415-2183 |
| ZMSC-2-1 | 5985-01-333-1128 |
| ZMSC-2-1B | 5895-01-253-2445 |
| ZMSC-2-1BR | 5985-01-338-9329 |
| ZMSC-2-1W | 5895-01-127-0232 |

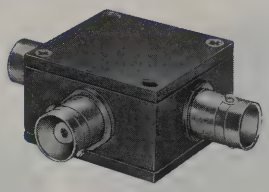
| MCL NO. | NSN |
|---|---|
| ZSC-2-1(TNC) | 6625-01-310-2129 |
| ZSC-2-1 | 5895-01-214-6032 |
| ZSC-2-1B | 6625-01-018-1066 |
| ZSC-2-1B(TNC) | 6625-01-109-3706 |
| ZSC-2-1(BNC) | 5895-01-036-6254 |
| ZSC-2-1B(BNC) | 6625-00-270-3055 |
| ZSC-2-1W | 5895-01-283-0850 |
| ZSC-2-1WB | 6625-01-264-8985 |
| ZSC-2-1-75B | 5895-01-136-8182 |
| ZSC-2-2B | 5820-01-136-7245 |
| ZSC-2-2-75B | 5915-01-012-8162 |
| ZSC-2375 | 5895-01-229-0157 |

In Stock... Immediate Delivery

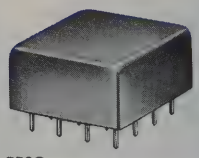
For Custom Versions Of Standard Models Consult Our Applications Dept.

# POWER SPLITTERS/COMBINERS 50 Ω

## 2 WAY-0° RESISTIVE DC to 4200 MHz



ZFRSC



PRSC

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB M Typ. | ISOLATION dB U Typ. | INSERTION LOSS, dB Above 6dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| △ | ZFRSC-42 | DC-4200 | 6.2 | 6.5 | 7.0 | 0.1 | 0.2 | 0.1 | 0.5 | 0.4 | 1.4 | 1 | 3 | 5 | 0.1 | 0.2 | 0.5 | 2-90 | K18 | ar | 59.95 |
| ■ | ZFRSC-2075 | DC-2000 | 6.2 | 6.6 | 7.0 | 0.1 | 0.2 | 0.3 | 0.6 | 0.5 | 1.4 | 1 | 2 | 5 | 0.1 | 0.2 | 0.5 | 2-88 | K18 | ar | 59.95 |
| | ZFRSC-2050 | DC-2000 | 6.2 | 6.6 | 7.0 | 0.1 | 0.2 | 0.3 | 0.6 | 0.5 | 1.4 | 1 | 2 | 5 | 0.1 | 0.2 | 0.5 | 2-95 | K18 | ar | 59.95 |
| | PRSC-2050 | DC-2000 | 6.0 | 6.2 | 6.5 | 0.1 | 0.3 | 0.2 | 0.7 | 0.5 | 1.0 | 1 | 3 | 5 | 0.1 | 0.3 | 0.5 | 2-95 | C145 | au | 29.95 |

L = DC to 100 MHz M = mid range (100 MHz to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

Above models are resistive power dividers to enable frequency coverage from dc to the highest rated frequency. Since resistive power dividers do not provide a high degree of isolation (basically isolation equals the insertion loss between ports), an amplifier such as Mini-Circuits' ZFL series is recommended when high isolation is required. Matched power rating 0.75W, internal load dissipation 0.375W.

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

△ Available only with SMA connectors

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:

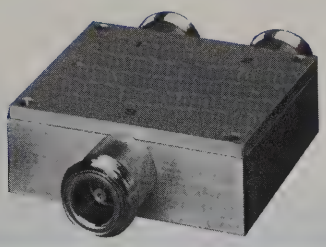
1a. Matched power rating,
model ZAPDQ 10 Watt
all other models 1 Watt

1b. Internal load dissipation, 0.125 Watt

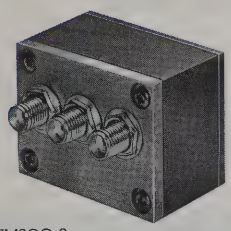


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

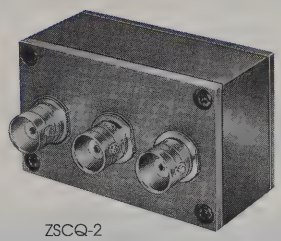
# 2 WAY-90° 20 to 4200 MHz



ZAPDQ



ZMSCQ-2



ZSCQ-2

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB Typ. | ISOLATION dB Min. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Typ. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Max. | PHASE UNBALANCE Degrees Max. | AMPLITUDE UNBALANCE dB Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ZAPDQ-2 | 1000-2000 | 22 | 16 | 0.4 | 1.4 | 6.0 | 0.8 | 2-42 | F14 | ar | 79.95 |
| ZAPDQ-4 | 2000-4200 | 22 | 16 | 0.4 | 0.9 | 8.0 | 1.0 | 2-42 | F14 | ar | 79.95 |
| ZMSCQ-2-21.4 | 20-23 | 30 | 25 | 0.4 | 0.7 | 3.0 | 1.2 | 2-39 | M21 | at | 61.95 |
| ZMSCQ-2-50 | 25-50 | 30 | 20 | 0.3 | 0.7 | 3.0 | 1.5 | 2-39 | M21 | at | 61.95 |
| ZMSCQ-2-90 | 55-90 | 30 | 20 | 0.3 | 0.7 | 3.0 | 1.2 | 2-40 | M21 | at | 61.95 |
| ZMSCQ-2-120 | 80-120 | 25 | 18 | 0.3 | 0.7 | 3.0 | 1.5 | 2-99 | M21 | at | 61.95 |
| ZMSCQ-2-180 | 120-180 | 23 | 15 | 0.3 | 0.7 | 4.0 | 1.2 | 2-40 | M21 | at | 61.95 |
| ZSCQ-2-50 | 25-50 | 30 | 20 | 0.3 | 0.7 | 3.0 | 1.5 | 2-39 | M22 | at | 54.95 |
| ZSCQ-2-90 | 55-90 | 30 | 20 | 0.3 | 0.7 | 3.0 | 1.2 | 2-39 | M22 | at | 54.95 |
| ZSCQ-2-180 | 120-180 | 23 | 15 | 0.3 | 0.7 | 4.0 | 1.2 | 2-40 | M22 | at | 54.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| ZAPDQ-4 | 5985-01-412-9064 |
| ZMSCQ-2-250 | 5985-01-394-4982 |
| ZFRSC-2050B | 5985-01-310-5748 |
| ZFRSC-2075 | 5985-01-266-6144 |
| ZFRSC-42 | 5985-01-332-3083 |

* units are not QPL listed

## pin and coaxial connections

see case style outline drawings for pin connections

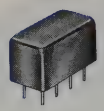
| PORT | ar | at | au |
|---|---|---|---|
| SUM PORT | 3 | 2 | 5 |
| PORT 1 | 1 | 1 | 3 |
| PORT 2 | 2 | 3 | 15 |
| GND EXT. | -- | | 1,2,4,8,9,12,13,14,16 |
| CASE GND | -- | | 1,2,4,8,9,12,13,14,16 |

CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

## 2 WAY-90° 0.42 MHz to 4200 MHz



PSCQ-2 / PQW-2

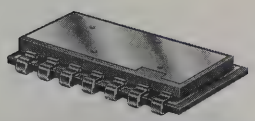
| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB Typ. | ISOLATION dB Min. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Typ. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Max. | PHASE UNBALANCE Degrees Max. | AMPLITUDE UNBALANCE dB Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PQW-2-90 | 30-90 | 27 | 20 | 0.3 | 0.6 | 3 | 1.0 | — | A01 | gy | 27.95 |
| NEW | PQW-2-270 | 90-270 | 20 | 17 | 0.4 | 0.7 | 4 | 1.4 | — | A01 | gy | 29.95 |
| | PSCQ-2-0.455 | 0.42-0.51 | 30 | 25 | 0.1 | 0.5 | 3 | 1.2 | 2-99 | A01 | aw | 25.95 |
| | PSCQ-2-1.25 | 1.13-1.38 | 29 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-36 | A01 | aw | 14.95 |
| | PSCQ-2-1.5 | 1.4-1.7 | 29 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-36 | A01 | aw | 14.95 |
| | PSCQ-2-3.4 | 3.0-3.8 | 30 | 25 | 0.4 | 0.7 | 3.8 | 1.2 | 2-36 | A01 | aw | 19.95 |
| | PSCQ-2-4.0 | 3.5-4.5 | 36 | 25 | 0.4 | 0.7 | 3 | 1.5 | 2-100 | A01 | aw | 14.95 |
| | PSCQ-2-6.4 | 5.8-7.0 | 30 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-37 | A01 | aw | 14.95 |
| | PSCQ-2-7.5 | 7-8 | 35 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-37 | A01 | aw | 14.95 |
| | PSCQ-2-8 | 2-8 | 36 | 27 | 0.3 | 0.7 | 6 | 0.5 | — | A01 | gx | 49.95 |
| | PSCQ-2-10.5 | 9-11 | 25 | 20 | 0.4 | 0.7 | 3 | 1.2 | 2-37 | A01 | aw | 14.95 |
| | PSCQ-2-13 | 12-14 | 29 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-38 | A01 | aw | 14.95 |
| | PSCQ-2-14 | 12-16 | 30 | 25 | 0.3 | 0.6 | 3 | 1.8 | 2-38 | A01 | aw | 19.95 |
| | PSCQ-2-17.5 | 16-19 | 28 | 25 | 0.6 | 0.7 | 3 | 1.6 | 2-38 | A01 | aw | 14.95 |
| | PSCQ-2-21.4 | 20-23 | 30 | 25 | 0.4 | 0.7 | 3 | 1.2 | 2-39 | A01 | aw | 14.95 |
| | PSCQ-2-26 | 14-30 | 25 | 20 | 0.4 | 0.7 | 3 | 1.5 | 2-100 | A01 | aw | 23.95 |
| | PSCQ-2-32 | 3.2-32 | 32 | 25 | 0.4 | 0.8 | 5 | 0.4 | — | A01 | gx | 89.95 |
| | PSCQ-2-40 | 23-40 | 21 | 18 | 0.3 | 0.7 | 3 | 1.5 | 2-100 | A01 | aw | 19.95 |
| | PSCQ-2-50 | 25-50 | 30 | 20 | 0.3 | 0.7 | 3 | 1.5 | 2-39 | A01 | aw | 23.95 |
| | PSCQ-2-60 | 30-60 | 30 | 20 | 0.3 | 0.7 | 3 | 1.5 | — | A01 | aw | 23.95 |
| | PSCQ-2-70 | 40-70 | 30 | 20 | 0.3 | 0.7 | 3 | 1.5 | 2-39 | A01 | aw | 23.95 |
| | PSCQ-2-70N | 66-74 | 22 | 19 | 0.2 | 0.5 | 0.8 | 0.25 | 2-101 | A01 | aw | 23.95 |
| | PSCQ-2-85A | 55-85 | 35 | 20 | 0.3 | 0.6 | 3 | 0.6 | — | A01 | ax | 24.95 |
| | PSCQ-2-90 | 55-90 | 30 | 20 | 0.3 | 0.7 | 3 | 1.2 | 2-40 | A01 | aw | 23.95 |
| | PSCQ-2-120 | 80-120 | 25 | 18 | 0.3 | 0.7 | 3 | 1.5 | 2-40 | A01 | aw | 23.95 |
| | PSCQ-2-160 | 100-160 | 24 | 19 | 0.3 | 0.7 | 3 | 1.5 | 2-101 | A01 | aw | 23.95 |
| | PSCQ-2-180 | 120-180 | 23 | 15 | 0.3 | 0.7 | 4 | 1.2 | 2-40 | A01 | aw | 23.95 |
| | PSCQ-2-250 | 150-250 | 30 | 22 | 0.4 | 0.8 | 4 | 1.5 | 2-41 | A01 | aw | 23.95 |
| | PSCQ-2-300 | 220-300 | 27 | 20 | 0.3 | 0.7 | 3 | 1.3 | 2-101 | A01 | aw | 23.95 |
| | PSCQ-2-400 | 250-400 | 23 | 16 | 0.5 | 0.9 | 4 | 1.5 | 2-41 | A01 | aw | 23.95 |
| | PSCQ-2-450 | 350-450 | 23 | 16 | 0.5 | 0.9 | 5 | 1.5 | 2-41 | A01 | aw | 23.95 |
| | PSCQ-2-550 | 450-550 | 19 | 15 | 0.4 | 0.7 | 5 | 1.5 | 2-42 | A01 | aw | 23.95 |
| | PSCQ-2-1000 | 800-1000 | 27 | 20 | 0.28 | 0.6 | 3 | 1.3 | 2-109 | A05 | ax | 25.95 |

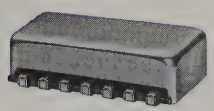
NOTES:

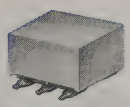
❑ Non-hermetic
** LRPQ units have bottom barrier ground plane insulated with glass barrier.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating
   models PSCQ-2-8,PSCQ-2-32 50mWatt
   models SCPQ-10.5 0.5 Watt
   all other models 1Watt
   1b. Internal load dissipation 0.125 Watt

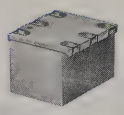


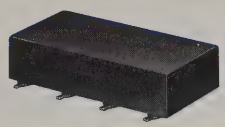

Mini-Circuits® INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

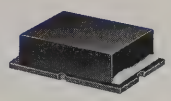

JSPQ


JSPQW


LRPQ


RPQ


SCPQ


SYPQ

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB Typ. | ISOLATION dB Min. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3 dB Typ. | INSERTION LOSS, dB Avg. of Coupled Outputs less 3 dB Max. | PHASE UNBALANCE Degrees Max. | AMPLITUDE UNBALANCE dB Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | JSPQ-1875W | 1325-1875 | 28 | 18 | 0.2 | 0.5 | 6 | 1.0 | — | BK343 | ja | 17.95 |
| | JSPQW-100 | 40-100 | 24 | 18 | 0.2 | 0.6 | 3 | 1.2 | — | BK276 | hm | 14.95 |
| | LRPQ-70** | 65-75 | 30 | 20 | 0.1 | 0.5 | 3 | 1 | 2-119 | QQQ130 | ay | 9.95 |
| | LRPQ-700** | 500-700 | 23 | 18 | 0.2 | 0.6 | 3 | 1.5 | 2-119 | QQQ130 | ay | 9.95 |
| | LRPQ-980** | 820-980 | 28 | 20 | 0.15 | 0.5 | 4 | 1 | 2-120 | QQQ130 | ay | 13.95 |
| | RPQ-820 | 760-860 | 22 | 15 | 0.15 | 0.7 | 4 | 1 | — | TT100 | gp | 13.95 |
| | RPQ-1495 | 1400-1600 | 18 | 14 | 0.3 | 0.8 | 5 | 1 | — | TT100 | gp | 15.95 |
| | SCPQ-10.5 | 9-11 | 31 | 20 | 0.15 | 0.7 | 3 | 1.2 | — | YY101 | aw | 13.95 |
| | SCPQ-21.4 | 20-23 | 32 | 25 | 0.15 | 0.5 | 2.5 | 1 | 2-98 | YY101 | aw | 13.95 |
| | SCPQ-50 | 25-50 | 25 | 20 | 0.15 | 0.7 | 3 | 1.5 | — | YY101 | aw | 14.95 |
| | SCPQ-60 | 30-60 | 30 | 20 | 0.15 | 0.7 | 3 | 1.5 | — | YY101 | aw | 14.95 |
| | SCPQ-85C | 55-85 | 30 | 20 | 0.3 | 0.6 | 3 | 0.6 | — | YY101 | gy | 14.95 |
| | SCPQ-90 | 55-90 | 26 | 20 | 0.2 | 0.7 | 3 | 1.2 | 2-98 | YY101 | aw | 13.95 |
| | SCPQ-150 | 95-150 | 22 | 18 | 0.3 | 0.7 | 3 | 1.2 | — | YY101 | aw | 14.95 |
| | SCPQ-180 | 120-180 | 20 | 16 | 0.3 | 0.7 | 3 | 1.2 | 2-98 | YY161 | aw | 13.95 |
| | SCPQ-400 | 250-400 | 20 | 16 | 0.3 | 0.7 | 3 | 1.2 | 2-99 | YY161 | aw | 14.95 |
| | SYPQ-21.4 | 20-23 | 33 | 25 | 0.1 | 0.4 | 3 | 1.1 | 2-98 | AH202 | av | 13.95 |
| | SYPQ-70 | 65-75 | 31 | 24 | 0.1 | 0.4 | 3 | 1.1 | 2-119 | AH202 | av | 13.95 |
| | SYPQ-113-1 | 108-118 | 25 | 20 | 0.15 | 0.4 | 3 | 1.0 | — | AH202 | av | 13.95 |

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PSCQ-2-21.4 | 6625-01-415-3074 |
| PSCQ-2-180 | 6625-01-186-4456 |
| PSCQ-2-90 | 6625-01-160-0151 |
| PSCQ-2-70 | 5985-01-292-8834 |
| PSCQ-2-50 | 5895-01-374-0023 |
| PSCQ-2-550 | 5895-01-347-0206 |

## pin connections see case style outline drawings

| PORT | av | aw | ax | ay | gp | gx | gy | hm | ja |
|---|---|---|---|---|---|---|---|---|---|
| SUM PORT | 1 | 1 | 1 | 6 | 4 | 1 | 1 | 9 | 1 |
| PORT 1 | 5 | 2 | 2 | 4 | 1 | 2 | 2(0°) | 2(0°) | 8 |
| PORT 2 | 8 | 5 | 8 | 1 | 3 | 5 | 6(90°) | 6(-90°) | 14 |
| GND EXT. | 2,3,6,7 | 3,4,7,8 | 3,4,5,6 | 2,5 | 2,5 | 3,4,7,8 | 3,4,7,8 | 1,3,4,5,7,8 | 2,3,4,5,6,9 |
| | | | 3,5,6 | | | — | | 10,11,12,14 | 10.11.12.13 |
| 50 OHM TERM. | 4 | 6 | 7 | 3 | 6 | — | 5 | 13 | 7 |

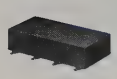
In Stock... Immediate Delivery

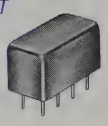
For Custom Versions Of Standard Models Consult Our Applications Dept.

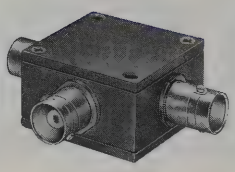
# POWER SPLITTERS/COMBINERS 50 & 75Ω

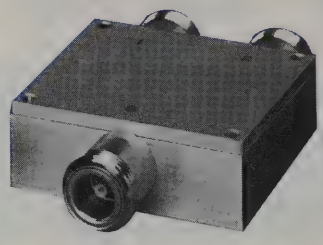
## 2 WAY-180° 10 kHz to 2 GHz

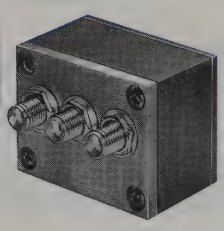
SURFACE MOUNT

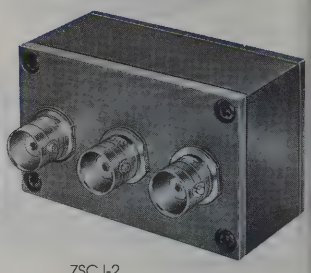

SCPJ


PSCJ-2


ZFSCJ-2


ZAPDJ-2


ZMSCJ-2


ZSCJ-2

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB L Min. | ISOLATION dB M° Typ. | ISOLATION dB M° Min. | ISOLATION dB U Typ. | ISOLATION dB U Min. | INSERTION LOSS, dB Above 3dB L Typ. | INSERTION LOSS, dB Above 3dB L Max. | INSERTION LOSS, dB Above 3dB M° Typ. | INSERTION LOSS, dB Above 3dB M° Max. | INSERTION LOSS, dB Above 3dB U Typ. | INSERTION LOSS, dB Above 3dB U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ■ | SCPJ-2-1W-75 | 10-500 | 30 | 25 | 27 | 20 | 22 | 16 | 1.0 | 1.5 | 1.1 | 1.6 | 1.5 | 2.2 | 3 | 4 | 6 | 0.3 | 0.5 | 0.9 | — | YY161 | az | 26.95 |
| **■ | SCPJ-2-750-75 | 30-750 | 26 | 20 | — | — | 26 | 16 | 1.0 | 1.5 | — | — | 1.5 | 2.2 | 3 | — | 6 | 0.8 | — | 0.9 | — | YY161 | az | 27.95 |
| | PSCJ-2-1 | 1-200 | 35 | 30 | 35 | 25 | 30 | 23 | 0.75 | 1 | 0.5 | 0.8 | 0.75 | 1.2 | 2 | 2.5 | 4 | 0.3 | 0.15 | 0.3 | 2-43 | A01 | az | 23.95 |
| | PSCJ-2-1W | 100-600 | | | 30 | 20 | | | | | 1.0 | 1.9 | | | | 6 | | | 0.5 | | — | A06 | az | 26.95 |
| ✣ | PSCJ-2-2 | 0.01-20 | 35 | 25 | 30 | 25 | 25 | 18 | 0.3 | 0.8 | 0.2 | 0.5 | 0.3 | 0.6 | 1* | 2 | 2.5 | 0.1 | 0.1 | 0.2 | 2-43 | A01 | az | 34.95 |
| ■ | PSCJ-2-1-75 | 1-200 | 35 | 30 | 31 | 25 | 26 | 20 | 0.6 | 1.2 | 0.8 | 1.2 | 1.2 | 1.8 | 2 | 4 | 6 | 0.25 | 0.2 | 0.5 | 2-45 | A01 | az | 23.95 |
| | ZFSCJ-2-1 | 1-500 | 30 | 20 | 33 | 25 | 30 | 18 | 1 | 1.5 | 1 | 1.5 | 1 | 1.5 | 2 | 4 | 7 | 0.5 | 0.2 | 0.5 | 2-44 | K18 | as | 59.95 |
| △✣ | ZFSCJ-2-2 | 0.01-20 | 35 | 25 | 30 | 25 | 25 | 18 | 0.3 | 0.8 | 0.2 | 0.5 | 0.3 | 0.6 | 1* | 2 | 2.5 | 0.1 | 0.1 | 0.2 | 2-43 | K18 | as | 57.95 |
| | ZFSCJ-2-3 | 5-300 | 30 | 20 | 33 | 25 | 30 | 18 | 1 | 1.5 | 1 | 1.5 | 1 | 1.5 | 2 | 4 | 6 | 0.15 | 0.2 | 0.5 | 2-44 | K18 | as | 49.95 |
| △ | ZFSCJ-2-4 | 50-1000 | 30 | 20 | — | — | 25 | 18 | 1.2 | 1.9 | — | — | 1.6 | 2.4 | 6 | — | 7 | 0.6 | — | 0.6 | 2-102 | K18 | as | 69.95 |
| | ZMSCJ-2-1 | 1-200 | 35 | 30 | 35 | 25 | 30 | 23 | 0.75 | 1 | 0.6 | 0.8 | 0.75 | 1.2 | 2 | 2.5 | 4 | 0.15 | 0.15 | 0.3 | 2-45 | M21 | at | 57.95 |
| ✣ | ZMSCJ-2-2 | 0.01-20 | 35 | 25 | 30 | 25 | 25 | 18 | 0.3 | 0.8 | 0.2 | 0.5 | 0.3 | 0.6 | 1* | 2 | 2.5 | 0.1 | 0.1 | 0.2 | 2-43 | M21 | at | 67.95 |
| | ZSCJ-2-1 | 1-200 | 35 | 30 | 35 | 25 | 30 | 23 | 0.75 | 1 | 0.6 | 0.8 | 0.75 | 1.2 | 2 | 2.5 | 4 | 0.15 | 0.15 | 0.3 | 2-45 | M22 | at | 51.95 |
| ✣ | ZSCJ-2-2 | 0.01-20 | 35 | 25 | 30 | 25 | 25 | 18 | 0.3 | 0.8 | 0.2 | 0.5 | 0.3 | 0.6 | 1* | 2 | 2.5 | 0.1 | 0.1 | 0.2 | 2-43 | M22 | at | 59.95 |
| | ZAPDJ-2 | 1000-2000 | 22 | 18 | 22 | 18 | 22 | 18 | 1.3 | 1.8 | 1.3 | 1.8 | 1.3 | 1.8 | 6 | 6 | 6 | 0.8 | 0.8 | 0.8 | 2-102 | F14 | as | 71.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

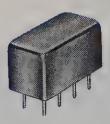
❑ Non-hermetic
* Phase unbalance is 3 degrees max from fL to 3 fL.
** For SCPJ-2-750-75: L=30-375 MHz, U=375-750 MHz
✪ When only specification for M range given, specifications applied to entire frequency range.
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
△ Available only with SMA connectors.
✣ At low range frequency band (fL to 10 fL), linearly derate maximum input power by 13 dB.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Matched power rating, 1 Watt, except models PSCJ-2-1W and SCPJ-2-1W-75, SCPJ-2-750-75 0.5 Watt
1b. Internal load dissipation 0.125 Watt



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

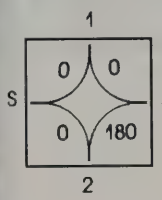
# 2 WAY-0°/180° 5 to 200 MHz



PMT

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 3dB | | | | | | PHASE UNBALANCE Degrees | | | AMPLITUDE UNBALANCE dB | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M | | U | | L | | M | | U | | L | M | U | L | M | U | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Page | Note B | | Qty. (1-9) |
| PMT-1 | 5-200 | 22 | 20 | 24 | 20 | 24 | 18 | 0.8 | 1.0 | 0.9 | 1.1 | 1.0 | 1.5 | 2 | 4 | 8 | 0.1 | 0.2 | 0.5 | 2-83 | A01 | ba | 23.95 |
| PMT-1-75 | 5-200 | 22 | 18 | 22 | 18 | 22 | 18 | 1.0 | 1.3 | 1.0 | 1.4 | 1.0 | 1.5 | 2 | 4 | 8 | 0.1 | 0.2 | 0.5 | 2-83 | A01 | ba | 23.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)




- S-J ports, isolation 40 dB typical
- Inphase ports, S-1 and S-2, insertion loss 0.2 dB typical
- Amplitude unbalance defined by input S or J ports to output 1 and 2

## pin and coaxial connections

see case style outline drawing

| PORT | as | at | az | ba |
|---|---|---|---|---|
| SUM PORT | S | 2 | 1 | 1 |
| PORT 1 | 1 | 1 | 5 | 2 |
| PORT 2 | 2 | 3 | 6 | 3 |
| PORT J | | | — | 4 |
| GND EXT. | | | 2,3,4,7,8 | 5,6,7,8 |
| CASE GND | | | 2,3,4,7,8 | 5,6,7,8 |

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PSCJ-2-1 | 6625-01-413-2386 |
| PSCJ-2-2 | 5985-01-332-3084 |
| ZSCJ-2-2 | 5895-01-340-7761 |

In Stock... Immediate Delivery

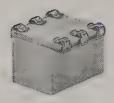
For Custom Versions Of Standard Models Consult Our Applications Dept.

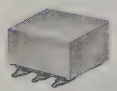
Available Tape & Reel

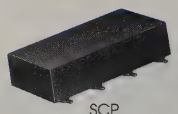
# POWER SPLITTERS/COMBINERS 50 & 75Ω

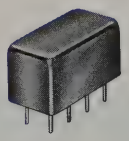
## 3 WAY-0° 10 kHz to 4.2 GHz

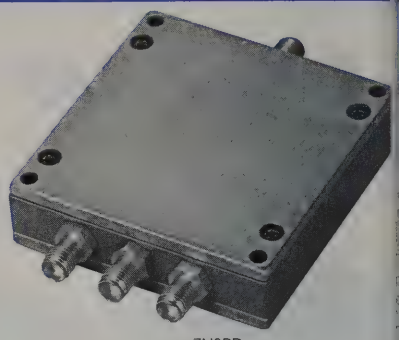
SURFACE MOUNT


JPS


LRPS


SCP


PSC-3


ZN3PD

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M° Typ. | M° Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 4.8dB L Typ. | L Max. | M° Typ. | M° Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M° Max. | U Max. | VSWR (:1) S Typ. | S Max. | OUT Typ. | OUT Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty (1-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L2 | | U2 | | | | L2 | | U2 | | | | L2 | U2 | | L2 | U2 | | | | | | | | | |
| NEW | JPS-3-1 | 5-300 | 34 | 25 | 33 | 23 | 32 | 20 | 0.3 | 0.6 | 0.3 | 0.7 | 0.5 | 1.4 | 2 | 4 | 6 | 0.4 | 0.4 | 0.6 | | | | | — | BH292 | jg | 13.9 |
| NEW | JPS-3-1W | 50-750 | 23 | 17 | 26 | 17 | | | 0.4 | 1.0 | 0.9 | 1.4 | | | 6 | 7 | | 0.3 | 0.6 | | | | | | — | BH292 | jg | 14.9 |
| | LRPS-3-1 | 10-300 | 25 | 20 | 25 | 20 | 25 | 20 | 0.2 | 0.6 | 0.3 | 0.8 | 0.5 | 1.2 | 2 | 3 | 4 | 0.1 | 0.3 | 0.7 | | | | | — | QQQ130 | gt | 19.9 |
| | LRPS-3-850 | 500-850 | | | 23 | 16 | | | | | 0.7 | 1.6 | | | | 6 | | | 0.9 | | see | | | | — | QQQ130 | hc | 16.9 |
| | SCP-3-1 | 1-300 | 30 | 25 | 25 | 20 | 20 | 15 | 0.3 | 0.6 | 0.4 | 0.8 | 0.7 | 1.5 | 1 | 2 | 4 | 0.1 | 0.15 | 0.5 | Performance | | | | 2-104 | YY101 | bd | 16.9 |
| | PSC-3-1 | 1-200 | 45 | 30 | 40 | 30 | 40 | 25 | 0.6 | 1.0 | 0.4 | 0.7 | 0.6 | 1 | 1 | 2 | 4 | 0.15 | 0.2 | 0.3 | Data and | | | | 2-46 | A01 | bb | 23.9 |
| | PSC-3-1A | 1-300 | 38 | 30 | 33 | 23 | 29 | 22 | 0.2 | 0.5 | 0.2 | 0.7 | 0.6 | 1.5 | 1 | 3 | 5 | 0.2 | 0.3 | 0.6 | | | | | 2-104 | A01 | bb | 26.9 |
| | PSC-3-1W | 5-500 | 25 | 20 | 31 | 15 | 25 | 15 | 0.4 | 0.8 | 0.4 | 1.4 | 0.8 | 1.4 | 2 | 3 | 5 | 0.1 | 0.3 | 0.6 | curves | | | | 2-46 | A01 | bc | 35.9 |
| ✣ | PSC-3-2 | 0.01-30 | 35 | 30 | 40 | 25 | 30 | 25 | 0.25 | 0.45 | 0.15 | 0.45 | 0.45 | 0.75 | 1 | 2 | 4 | 0.2 | 0.3 | 0.4 | | | | | 2-105 | A01 | bb | 35.9 |
| ■ | PSC-3-1-75 | 1-200 | 35 | 23 | 35 | 25 | 35 | 25 | 0.6 | 1.0 | 0.3 | 0.7 | 0.6 | 1 | 2 | 3 | 4 | 0.15 | 0.2 | 0.3 | | | | | 2-48 | A01 | bb | 23.9 |
| ■ | PSC-3-1-75-2 | 10-300 | 28 | 20 | 25 | 20 | 28 | 20 | 0.2 | 0.4 | 0.3 | 0.5 | 0.4 | 0.7 | 2 | 3 | 4 | 0.15 | 0.2 | 0.3 | | | | | 2-48 | A01 | bc | 27.9 |
| | PSC-3-13 | 1-200 | 45 | 35 | 45 | 30 | 37 | 30 | 0.25 | 0.5 | 0.35 | 0.6 | 0.35 | 0.8 | 1 | 3 | 4 | 0.1 | 0.2 | 0.2 | | | | | 2-47 | A01 | bb | 29.9 |
| | PSC-3-13-39 | 0.5-50 | 47 | 33 | 46 | 35 | 40 | 33 | 0.15 | 0.4 | 0.15 | 0.4 | 0.15 | 0.4 | 1 | 1 | 2 | 0.1 | 0.1 | 0.1 | | | | | 2-105 | A01 | bb | 29.9 |
| | ZN3PD-900 | 800-900 | | | 30 | 20 | | | | | 0.2 | 0.4 | | | | — | | | 0.5 | | 1.09 | 1.30 | 1.09 | 1.30 | 2-103 | UU181 | be | 74.9 |
| | ZN3PD-900W | 650-1050 | | | 22 | 15 | | | | | 0.3 | 0.8 | | | | — | | | 0.8 | | 1.09 | 1.80 | 1.09 | 1.30 | 2-103 | UU181 | be | 69.9 |

L = low range ($f_L$ to 10 $f_L$)
$L_2$ = ($f_L$ to $f_U$/2)

M = mid range (10 $f_L$ to $f_U$/2)
$U_2$ = ($f_U$/2 to $f_U$)

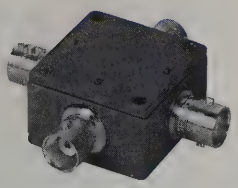
U = upper range ($f_U$/2 to $f_U$)

NOTES:

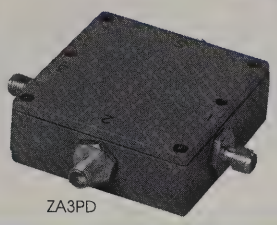
❑ Non-hermetic
* Isolation 25 dB, -55 to 0 deg.C over 0.01-0.1 MHz
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
✣ At low range frequency band ($f_L$ to 10 $f_L$), linearly derate maximum input power by 13 dB.
✪ When only specification for M range given, specifications apply to entire frequency range.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Matched power rating, models ZA3PD, ZN3PD 10 Watt
other models 1 Watt
1b. Internal load dissipation 0.375 Watt, except models JPS-3-1, JPS-3-1W, 0.5 Watt.



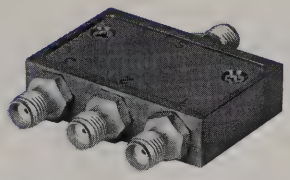
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



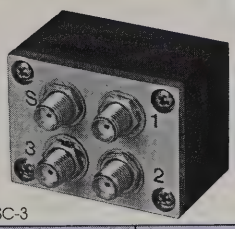
ZFSC-3



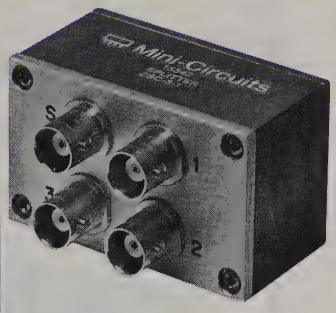
ZA3PD



ZCSC-3



ZMSC-3



ZSC-3

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 4.8dB | | | | | | PHASE UNBALANCE DEGREES | | | AMPLITUDE UNBALANCE dB | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M | | U | | L | | M | | U | | L | M | U | L | M | U | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Page | Note B | | Qty. (1-9) |
| | ZFSC-3-1 | 1-500 | 30 | 20 | 30 | 20 | 25 | 18 | 0.4 | 0.75 | 0.5 | 0.9 | 0.8 | 1.2 | 2 | 3 | 4 | 0.2 | 0.3 | 0.4 | 2-50 | J17 | be | 51.95 |
| | ZFSC-3-1W | 2-750 | 30 | 20 | 30 | 20 | 25 | 18 | 0.4 | 0.75 | 0.5 | 1.0 | 1.0 | 1.6 | 3 | 5 | 7 | 0.2 | 0.3 | 0.5 | 2-50 | J17 | be | 53.95 |
| | ZFSC-3-13 | 1-200 | 45 | 30 | 48 | 35 | 37 | 30 | 0.25 | 0.5 | 0.35 | 0.6 | 0.35 | 0.6 | 1 | 3 | 5 | 0.1 | 0.2 | 0.2 | 2-47 | J17 | be | 51.95 |
| | ZFSC-3-4 | 1-1000 | 35 | 20 | 20 | 18 | 20 | 17 | 0.2 | 0.5 | 0.7 | 1.4 | 1.0 | 2.0 | 3 | 6 | 10 | 0.2 | 0.4 | 0.9 | 2-51 | J17 | be | 59.95 |
| | ZA3PD-1 | 500-1000 | 20 | 14 | 20 | 14 | 20 | 14 | 0.3 | 0.6 | 0.3 | 0.6 | 0.3 | 0.6 | — | — | — | 0.4 | 0.4 | 0.4 | 2-52 | CC51 | be | 89.95 |
| | ZA3PD-1.5 | 750-1500 | 20 | 14 | 20 | 14 | 20 | 14 | 0.3 | 0.7 | 0.3 | 0.7 | 0.3 | 0.7 | — | — | — | 0.4 | 0.4 | 0.4 | 2-52 | CC51 | be | 89.95 |
| | ZA3PD-2 | 1000-2000 | 20 | 15 | 20 | 15 | 20 | 15 | 0.3 | 0.6 | 0.3 | 0.6 | 0.3 | 0.6 | — | — | — | 0.3 | 0.3 | 0.3 | 2-53 | CC51 | be | 89.95 |
| | ZA3PD-4 | 2000-4200 | 18 | 14 | 18 | 14 | 18 | 14 | 0.7 | 1.0 | 0.7 | 1.0 | 0.7 | 1.0 | — | — | — | 0.9 | 0.9 | 0.9 | 2-53 | CC51 | be | 89.95 |
| | ZCSC-3-R3 | 2-300 | 32 | 28 | 31 | 28 | 32 | 22 | 0.3 | 0.8 | 0.4 | 1.0 | 0.8 | 1.2 | 1 | 2 | 3 | 0.1 | 0.3 | 0.3 | — | UU233 | be | 43.95 |
| | ZMSC-3-1 | 1-200 | 45 | 35 | 40 | 25 | 40 | 25 | 0.3 | 0.5 | 0.4 | 0.7 | 0.6 | 1 | 1 | 2 | 4 | 0.15 | 0.2 | 0.3 | 2-51 | P26 | be | 57.95 |
| ❖ | ZMSC-3-2* | 0.01-30 | 35 | 30 | 40 | 25 | 30 | 25 | 0.25 | 0.45 | 0.15 | 0.45 | 0.45 | 0.75 | 1 | 2 | 4 | 0.2 | 0.3 | 0.4 | 2-47 | P26 | be | 67.95 |
| | ZSC-3-1 | 1-200 | 45 | 30 | 40 | 25 | 40 | 25 | 0.3 | 0.5 | 0.4 | 0.7 | 0.6 | 1.0 | 1 | 2 | 4 | 0.15 | 0.2 | 0.3 | 2-51 | P25 | be | 51.95 |
| ❖ | ZSC-3-2* | 0.01-30 | 35 | 30 | 40 | 25 | 30 | 25 | 0.25 | 0.45 | 0.15 | 0.45 | 0.45 | 0.75 | 1 | 2 | 4 | 0.2 | 0.3 | 0.4 | 2-47 | P25 | be | 61.95 |
| ■ | ZSC-3-1-75 | 1-200 | 35 | 30 | 35 | 25 | 35 | 25 | 0.6 | 1.0 | 0.4 | 0.7 | 0.6 | 1.0 | 2 | 3 | 4 | 0.15 | 0.2 | 0.3 | 2-48 | P25 | be | 52.95 |
| ·■ | ZSC-3-2-75 | 0.02-20 | 35 | 30 | 35 | 25 | 30 | 20 | 0.2 | 0.5 | 0.25 | 0.6 | 0.45 | 0.75 | 2 | 3 | 4 | 0.2 | 0.3 | 0.4 | 2-49 | P25 | be | 62.95 |

L = low range ($f_L$ to 10 $f_L$)  M = mid range (10 $f_L$ to $f_U$/2)  U = upper range ($f_U$/2 to $f_U$)

## pin and coaxial connections

see case style outline drawings

| PORT | bb | bc | bd | be | gt | hc | jg |
|---|---|---|---|---|---|---|---|
| SUM PORT | 6 | 1 | 6 | S | 6 | 6 | 1 |
| PORT 1 | 1 | 5 | 1 | 1 | 1 | 1 | 6 |
| PORT 2 | 2 | 7 | 2 | 2 | 2 | 3 | 4 |
| PORT 3 | 5 | 8 | 5 | 3 | 3 | 4 | 3 |
| GND EXT. | 3,4,7,8 | 2,3,4,6 | 3,4,7,8 | | 4,5 | 2,5 | 2,5 |
| CASE GND | 3,4,7,8 | 2,3,4,6 | — | | — | — | — |

### MIL-P-23971/15, NSN GUIDE

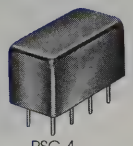
| MCL NO. | NSN |
|---|---|
| PSC-3-1 | 6625-01-015-6027 |
| PSC-3-1W | 5985-01-295-5898 |
| PSC-3-13 | 6625-01-249-8011 |
| ZFSC-3-4(SMA) | 6625-01-333-1126 |
| ZFSC-3-1 | 6625-01-235-6873 |
| ZFSC-3-13 | 5895-01-335-1824 |
| ZFSC-3-13(SMA) | 5985-01-409-0884 |
| ZMSC-3-2B | 6625-01-303-4624 |
| ZMSC-3-1B(SMA) | 6625-01-170-0102 |
| ZSC-3-1 | 6625-01-327-4755 |
| ZSC-3-1B(BNC) | 6625-01-008-9566 |
| ZSC-3-2BR | 5985-01-315-2870 |
| ZSC-3-2B(BNC) | 5820-01-120-9320 |
| ZA3PD-2 | 5895-01-357-3919 |
| ZFSC-3-1(SMA) | 5895-01-361-8520 |

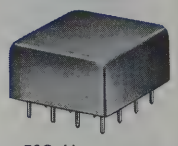
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

# 4 WAY-0° 10 kHz to 1000 MHz


PSC-4


PSC-4A

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 6dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M Max. | U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PSC-4-1 | 0.1-200 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.6 | 0.5 | 0.75 | 0.7 | 1 | 4 | 6 | 8 | 0.15 | 0.2 | 0.25 | 2-54 | A01 | bf | 35.95 |
| | PSC-4-1W | 1-500 | 29 | 20 | 27 | 18 | 25 | 18 | 0.4 | 0.8 | 0.5 | 1 | 0.8 | 1.5 | 1 | 3 | 5 | 0.2 | 0.3 | 0.5 | 2-106 | A01 | bf | 38.95 |
| ■ | PSC-4-1-75 | 1-200 | 30 | 20 | 25 | 20 | 25 | 20 | 0.4 | 0.7 | 0.5 | 0.9 | 0.7 | 1.2 | 2 | 3 | 4 | 0.15 | 0.2 | 0.3 | 2-62 | A01 | bf | 32.95 |
| | PSC-4-3 | 0.25-250 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.7 | 0.5 | 0.75 | 0.7 | 1.2 | 4 | 6 | 8 | 0.15 | 0.2 | 0.25 | 2-55 | A01 | bf | 31.95 |
| | PSC-4-5 | 1-800 | 29 | 20 | 24 | 18 | 25 | 17 | 0.4 | 0.8 | 0.6 | 1.5 | 1.3 | 2.5 | 1 | 4 | 5 | 0.2 | 0.5 | 0.6 | 2-106 | A01 | bf | 45.45 |
| ✣ | PSC-4-6 | 0.01-40 | 35 | 18 | 32 | 25 | 25 | 18 | 0.4 | 0.8 | 0.3 | 0.5 | 0.5 | 1 | 2 | 2 | 2 | 0.1 | 0.15 | 0.2 | 2-55 | A01 | bf | 36.95 |
| ■ | PSC-4-1W-75 | 5-650 | 38 | 22 | 40 | 22 | 25 | 18 | 0.6 | 0.9 | 0.65 | 1.2 | 0.9 | 1.5 | 1 | 3 | 5 | 0.2 | 0.3 | 0.6 | — | A05 | bf | 39.95 |
| | PSC-4A-4 | 10-1000 | 25 | 20 | 21 | 15 | 18 | 15 | 0.5 | 0.8 | 0.8 | 1.8 | 1.5 | 2.5 | 4 | 16 | 20 | 0.2 | 0.5 | 0.7 | 2-54 | C07 | bg | 64.95 |
| ■ | PSC-4A-475 | 10-800 | 30 | 20 | 33 | 20 | 25 | 18 | 0.4 | 0.7 | 0.6 | 0.9 | 1.2 | 1.6 | — | — | — | 0.2 | 0.4 | 0.8 | 2-62 | C07 | bg | 64.95 |
| ■ | PSC-4A-1W-75* | 30-600 | 27 | 20 | — | — | 22 | 18 | 0.6 | 0.8 | — | — | 0.8 | 1.1 | 2 | — | 5 | 0.2 | — | 5 | 2-107 | C07 | bg | 49.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

❑ Non-hermetic

■ Denotes 75 Ohm model

✪ When only specification for M range given, specification applies to entire frequency range.

✣ At low range frequency band ($f_L$ to 10$f_L$), linearly derate maximum power by 13 dB.

* Maximum VSWR: input 1.5:1, output 1.3:1

A. General Quality Control Procedures, Environmental Specifications, HI-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:

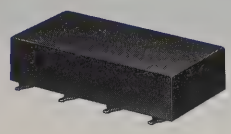
1a. Matched power rating,
Models PSC-4-5, PSC-4-1W, SCP-4-1W-75 0.5 Watt
All other models 1 Watt

1b. Internal load dissipation,
SCP-4-1W-75, SCP-4-4-75 0.375 Watt
All other models 0.250 Watt



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 1 to 1000 MHz



SCP

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 6dB | | | | | | PHASE UNBALANCE Degrees | | | AMPLITUDE UNBALANCE dB | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M○ | | U | | L | | M○ | | U | | L | M○ | U | L | M○ | U | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Page | Note B | | Qty. (1-9) |
| SCP-4-1 | 1-400 | 32 | 23 | 26 | 18 | 21 | 17 | 0.4 | 1.2 | 0.6 | 1.2 | 1.0 | 1.5 | 1 | 4 | 9 | 0.2 | 0.3 | 0.5 | — | YY101 | bv | 24.95 |
| SCP-4-1W | 10-650 | 34 | 28 | 23 | 18 | 21 | 15 | 0.7 | 1.0 | 0.9 | 1.5 | 1.1 | 1.9 | 3 | 7 | 12 | 0.2 | 0.4 | 0.7 | — | YY101 | bv | 26.95 |
| SCP-4-1W-75 | 10-750 | 36 | 20 | 32 | 20 | 24 | 15 | 0.5 | 1.0 | 0.65 | 1.3 | 0.8 | 2.0 | 1.5 | 3 | 6 | 0.2 | 0.4 | 0.9 | -- | YY161 | bv | 27.95 |
| SCP-4-4 | 800-1000 | | | 24 | 17 | | | | | 0.7 | 1.5 | | | | 12 | | | 1.0 | | — | YY101 | bv | 21.95 |
| SCP-4-4-75 | 10-1000 | 36 | 20 | 32 | 18 | 24 | 14 | 0.5 | 1.0 | 0.65 | 1.3 | 0.8 | 2.0 | 3 | 6 | 12 | 0.2 | 0.4 | 0.9 | -- | YY161 | bv | 28.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

## pin and coaxial connections

see case style outline drawing

| PORT | bf | bg | bv |
|---|---|---|---|
| SUM PORT | 4 | 2 | 3 |
| PORT 1 | 7 | 8 | 2 |
| PORT 2 | 8 | 12 | 4 |
| PORT 3 | 1 | 5 | 6 |
| PORT 4 | 2 | 9 | 8 |
| GND EXT. | 3,5,6 | All other pins | 1,5,7 |
| CASE GND | 3,5,6 | All other pins | |

**NSN GUIDE**

| MCL NO. | NSN | MIL-P-23971/15* |
|---|---|---|
| PSC-4-1 | 5895-01-065-0106 | -10 |
| PSC-4-2 | 5825-01-044-8945 | |
| PSC-4-3 | 5895-01-105-6189 | -11 |
| PSC-4-5 | 5985-01-423-7929 | |
| PSC-4-6 | 5985-01-332-3086 | |
| PSC-4A-4 | 5895-01-347-0205 | |

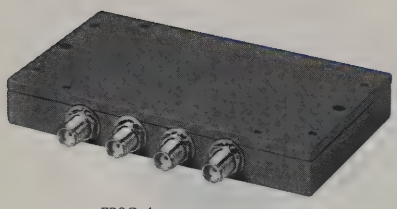
In Stock... Immediate Delivery

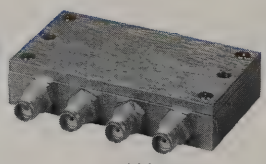
For Custom Versions Of Standard Models Consult Our Applications Dept.

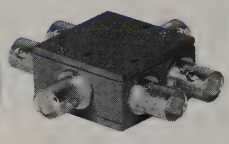
Available Tape & Reel

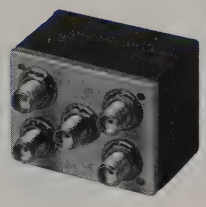
# POWER SPLITTERS/COMBINERS 50 & 75Ω

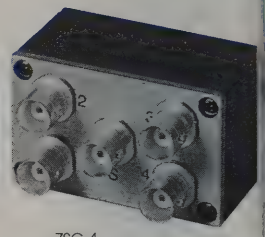
## 4 WAY-0° 2 kHz to 8.4 GHz


ZBSC-4


ZCSC-4


ZFSC-4


ZMSC-4



ZSC-4

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 6dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M Max. | U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZBSC-413 | 10-800 | 26 | 20 | 18 | 15 | 18 | 15 | 0.6 | 1 | 1 | 1.5 | 1.6 | 2 | 4 | 8 | 8 | 0.2 | 0.4 | 0.6 | 2-57 | UU102 | bh | 99.95 |
| ZCSC-4-1W | 10-650 | 34 | 22 | 23 | 17 | 21 | 15 | 0.7 | 1.2 | 0.9 | 1.5 | 1.1 | 1.9 | 3 | 7 | 12 | 0.2 | 0.4 | 0.7 | — | UU244 | bh | 79.95 |
| ZFSC-4-1 | 1-1000 | 25 | 20 | 23 | 18 | 20 | 15 | 0.4 | 1.2 | 0.6 | 1.5 | 1.6 | 2.5 | 4 | 8 | 8 | 0.2 | 0.4 | 0.7 | 2-56 | G15 | bh | 89.95 |
| ZFSC-4-1W | 10-500 | 23 | 20 | 23 | 20 | 23 | 20 | 0.6 | 1.5 | 0.6 | 1.5 | 0.6 | 1.5 | 4 | 8 | 8 | 0.2 | 0.3 | 0.4 | 2-50 | G15 | bh | 84.95 |
| ZFSC-4-3 | 10-300 | 32 | 28 | 38 | 30 | 38 | 30 | 0.5 | 0.8 | 0.6 | 0.9 | 0.9 | 1.2 | 4 | 6 | 8 | 0.1 | 0.1 | 0.2 | 2-57 | G15 | bh | 78.95 |
| ■ ZFSC-4375 | 50-90 | 34 | 30 | 34 | 30 | 34 | 30 | 0.3 | 0.8 | 0.3 | 0.8 | 0.3 | 0.8 | 4 | 6 | 8 | 0.15 | 0.15 | 0.15 | 2-63 | G15 | bh | 89.95 |
| ■ ZFSC-4-2-75-1** | 200-800 | 25 | 20 | — | — | 25 | 20 | 0.8 | 1.6 | — | — | 1 | 1.6 | 4 | 16 | 20 | 0.2 | — | 0.4 | 2-63 | G15 | bh | 84.95 |
| ■ ZFSC-4-175 | 10-1000 | 35 | 25 | 38 | 20 | 22 | 18 | 0.5 | 0.8 | 0.6 | 1.2 | 0.9 | 2 | — | — | — | 0.2 | 0.3 | 0.6 | 2-61 | G15 | bh | 89.95 |
| ZMSC-4-1 | 0.1-200 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.6 | 0.5 | 0.75 | 0.7 | 1.0 | 4 | 6 | 8 | 0.15 | 0.20 | 0.25 | 2-60 | N24 | bh | 66.95 |
| ✣ ZMSC-4-2 | 0.002-20 | 30 | 20 | 33 | 25 | 33 | 25 | 0.45 | 0.75 | 0.3 | 0.5 | 0.7 | 1.0 | 4 | 6 | 8 | 0.15 | 0.20 | 0.25 | 2-60 | N24 | bh | 76.95 |
| ZMSC-4-3 | 0.25-250 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.7 | 0.5 | 0.75 | 0.7 | 1.2 | 4 | 6 | 10 | 0.15 | 0.20 | 0.25 | 2-61 | N24 | bh | 64.95 |
| ZSC-4-1 | 0.1-200 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.6 | 0.5 | 0.75 | 0.7 | 1.0 | 4 | 6 | 8 | 0.15 | 0.20 | 0.25 | 2-60 | N27 | bh | 59.95 |
| ■ ZSC-4-1-75 | 1-200 | 30 | 20 | 25 | 20 | 25 | 20 | 0.4 | 0.7 | 0.5 | 0.8 | 0.7 | 1.2 | 4 | 6 | 10 | 0.15 | 0.20 | 0.30 | 2-62 | N27 | bh | 59.95 |
| ✣ ZSC-4-2 | 0.002-20 | 30 | 20 | 33 | 25 | 33 | 25 | 0.45 | 0.75 | 0.3 | 0.5 | 0.7 | 1.0 | 4 | 6 | 8 | 0.15 | 0.20 | 0.25 | 2-60 | N27 | bh | 74.95 |
| ZSC-4-3 | 0.25-250 | 33 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.7 | 0.5 | 0.75 | 0.7 | 1.2 | 4 | 6 | 10 | 0.15 | 0.20 | 0.25 | 2-61 | N27 | bh | 56.95 |
| ■ ZSC-4-3-75 | 0.25-250 | 28 | 20 | 30 | 20 | 27 | 20 | 0.4 | 0.8 | 0.3 | 0.7 | 0.5 | 1.0 | 1 | 2 | 3 | 0.15 | 0.20 | 0.25 | 2-107 | N27 | bh | 56.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

✪ When only specification for M range given, specification applies to entire frequency range.

✣ At low range frequency band ($f_L$ to 10$f_L$), linearly derate maximum power by 13 dB.

* Maximum VSWR: input 1.5:1, output 1.3:1

** Frequency range L=$f_L$ to $f_U$/2. Up to 15V and 15mA DC may be passed from input to all outputs.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

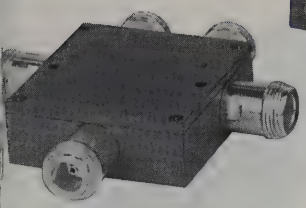
1. Absolute maximum power, voltage and current ratings:

1a. Matched power rating,
Models ZA4PD, ZB4PD-4, ZB4PD1(except -500-75), ZN4PD, ZC4PD 10W
Model ZCSC-4-1W 0.5W
All other models 1W

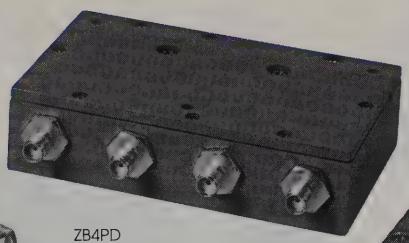
1b. Internal load dissipation,
Model ZB4PD-1750-75 0.750W
Models ZA4PD, ZB4PD-4, ZB4PD, ZB4PD1, ZN4PD, ZC4PD, ZCSC 0.375W
All other models 0.250W



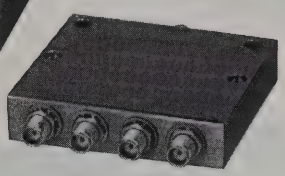
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



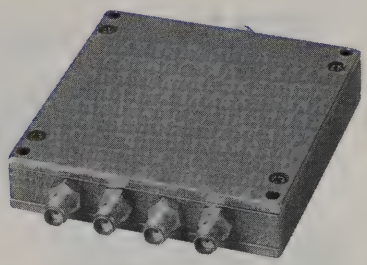
ZA4PD



ZB4PD
ZB4PD1



ZC4PD



ZN4PD

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M° Typ. | M° Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 3dB L Typ. | L Max. | M° Typ. | M° Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M° Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M° Max. | U Max. | VSWR (:1) S Typ. | S Max. | OUT Typ. | OUT Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZA4PD-2 | 1000-2000 | 25 | 16 | 25 | 16 | 25 | 16 | 0.3 | 1.0 | 0.3 | 1.0 | 0.3 | 1.0 | | 6 | | 0.70 | 0.70 | 0.70 | see | | | | 2-58 | DD52 | bh | 89.95 |
| ZA4PD-4 | 2000-4200 | 25 | 16 | 25 | 16 | 25 | 16 | 0.5 | 1.0 | 0.3 | 1.0 | 0.3 | 1.0 | | 16 | | 0.80 | 0.80 | 0.80 | Performance Data and curves | | | | 2-58 | DD52 | bh | 89.95 |
| ZB4PD-42 | 1700-4200 | 23 | 16 | 23 | 16 | 23 | 16 | 0.5 | 1.4 | 0.5 | 1.4 | 0.5 | 1.4 | | 8 | | 0.80 | 0.80 | 0.80 | | | | | 2-59 | Z54 | bh | 99.95 |
| ZB4PD-4 | 3700-4200 | 24 | 15 | 24 | 15 | 24 | 15 | 0.6 | 1.1 | 0.6 | 1.1 | 0.6 | 1.1 | | 8 | | 0.80 | 0.80 | 0.80 | | | | | 2-59 | Z54 | bh | 94.95 |
| ZB4PD-1750-75 | 875-1750 | | | 30 | 20 | | | | | 0.4 | 0.8 | | | | 3 | | | 0.40 | | 1.08 | 1.50 | 1.25 | 1.50 | — | UU188 | bh | 99.95 |
| ZB4PD1-500-75 | 5-500 | 34 | 20 | 34 | 20 | 30 | 20 | 0.45 | 1.0 | 0.6 | 0.9 | 1.0 | 1.5 | 1 | 3 | 6 | 0.20 | 0.20 | 0.30 | | | | | — | UU188 | bh | 89.95 |
| ZB4PD1-930W | 725-1050 | | | 22 | 15 | | | | | 0.3 | 0.8 | | | | 5 | | | 0.40 | | 1.20 | 1.80 | 1.10 | 1.30 | 2-111 | UU188 | bh | 94.95 |
| ZB4PD1-2000 | 800-2000 | | | 25 | 18 | | | | | 0.6 | 1.2 | | | | — | | | 0.30 | | 1.20 | 1.60 | 1.10 | 1.30 | — | UU188 | bh | 94.95 |
| ZB4PD1-930 | 850-930 | | | 30 | 20 | | | | | 0.3 | 0.5 | | | | 5 | | | 0.25 | | 1.10 | 1.25 | 1.09 | 1.25 | 2-111 | UU188 | bh | 99.95 |
| ZB4PD1-8.4 | 6700-8400 | | | 29 | 18 | | | | | 0.5 | 1.3 | | | | 9 | | | 0.90 | | 1.12 | 1.50 | 1.27 | 1.50 | — | UU188 | bh | 149.95 |
| ZC4PD-900 | 800-900 | | | 30 | 20 | | | | | 0.3 | 0.6 | | | | 3 | | | 0.20 | | 1.08 | 1.25 | 1.17 | 1.30 | 2-118 | Z184 | bh | 89.95 |
| ZN4PD-920 | 800-920 | | | 30 | 20 | | | | | 0.25 | 0.5 | | | | 2 | | | 0.20 | | 1.08 | 1.25 | 1.07 | 1.25 | 2-110 | UU182 | bh | 84.95 |
| ZN4PD-920W | 670-1000 | | | 22 | 15 | | | | | 0.3 | 0.6 | | | | 3 | | | 0.20 | | 1.20 | 1.60 | 1.07 | 1.25 | 2-110 | UU182 | bh | 79.95 |

L = low range ($f_L$ to 10 $f_L$)  M = mid range (10 $f_L$ to $f_U$/2)  U = upper range ($f_U$/2 to $f_U$)

## pin and coaxial connections

see case style outline drawing

| PORT | bh |
|---|---|
| SUM PORT | S |
| PORT 1 | 1 |
| PORT 2 | 2 |
| PORT 3 | 3 |
| PORT 4 | 4 |

### NSN GUIDE

| MCL NO. | NSN |
|---|---|
| ZBSC-413(SMA) | 5985-01-370-6145 |
| ZFSC-4-1 | 6625-01-303-4623 |
| ZFSC-4-1(SMA) | 6625-01-303-4623 |
| ZFSC-4-1A | 5825-01-227-6681 |
| ZFSC-4-1W(SMA) | 5985-01-372-6418 |
| ZFSC-4-1WB(SMA) | 5985-01-364-1944 |
| ZFSC-4-3B | 5985-01-253-2843 |
| ZMSC-4-1B | 4935-01-229-3228 |
| ZSC-4-1B | 5820-00-270-3056 |
| ZSC-4-1B(BNC) | 6625-00-270-3056 |
| ZSC-4-1B(TNC) | 6625-01-109-3707 |
| ZSC-4-1-75 | 5998-01-228-8995 |
| ZSC-4-2BR | 6625-01-357-2227 |
| ZSC-4-2B(BNC) | 5820-01-120-5238 |
| ZSC-4-3B | 6625-01-038-8553 |

* units are not QPL listed.

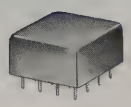
CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

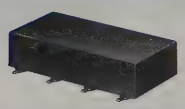
# POWER SPLITTERS/COMBINERS 50 & 75Ω

## 5 WAY-0° 1 MHz to 750 MHz

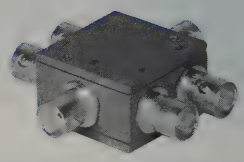


PSC-5

SURFACE MOUNT



SCP-5



ZFSC-5

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 7.0dB | | | | | | PHASE UNBALANCE Degrees | | | AMPLITUDE UNBALANCE dB | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M° | | U | | L | | M° | | U | | L | M° | U | L | M° | U | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Page | Note B | | Qty. (1-9) |
| PSC-5-1 | 1-300 | 25 | 20 | 23 | 18 | 20 | 17 | 0.2 | 0.5 | 0.6 | 1.0 | 1.5 | 2.0 | 2 | 4 | 8 | 0.2 | 0.3 | 0.6 | 2-64 | C07 | bj | 64.45 |
| PSC-5-2 | 250-750 | | | 22 | 17 | | | | | 1.1 | 2.5 | | | | 14 | | | 0.7 | | --- | C07 | gq | 67.95 |
| ■ PSC-5-1-75 | 1-300 | 35 | 20 | 30 | 18 | 25 | 17 | 0.4 | 0.6 | 0.6 | 0.9 | 0.9 | 1.3 | 2 | 4 | 8 | 0.2 | 0.3 | 0.6 | 2-64 | C07 | bj | 64.45 |
| SCP-5-1 | 2-200 | 30 | 20 | 29 | 20 | 30 | 20 | 0.2 | 0.5 | 0.3 | 0.75 | 0.6 | 1.5 | 1 | 3 | 5 | 0.2 | 0.3 | 0.6 | -- | YY161 | hv | 26.95 |
| ZFSC-5-1 | 1-300 | 25 | 20 | 23 | 18 | 20 | 17 | 0.2 | 0.5 | 0.6 | 1.0 | 1.5 | 2.0 | 2 | 4 | 8 | 0.2 | 0.3 | 0.6 | 2-64 | G15 | bm | 99.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

❑ Non-hermetic
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
✪ When only specification for M range given, specification applies to entire frequency range.
△ Available only with SMA connectors.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:

1a. Matched power rating:

| | |
|---|---|
| Models ZB6PD, ZC6PD | 10 Watt |
| Model PSC-5-2 | 2 Watt |
| All other models | 1 Watt |

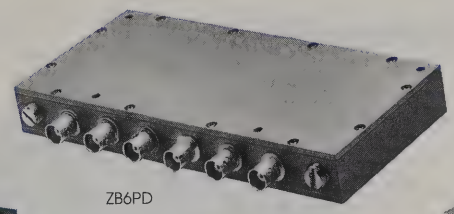
1b. Internal load dissipation:

| | |
|---|---|
| Models ZB6PD, ZC6PD | 0.875 Watt |
| ZB6PD-1700 | 0.750 Watt |
| Model PSC-5-2, SCP-5-1 | 0.625 Watt |
| All other models | 0.500 Watt |

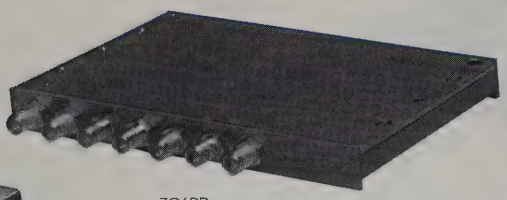


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

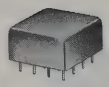
# 6 WAY-0° 1 MHz to 2 GHz



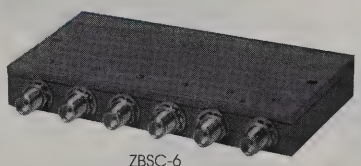
ZB6PD



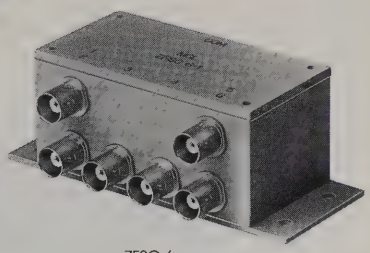
ZC6PD



PSC-6



ZBSC-6



ZFSC-6

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. Min. | ISOLATION dB M° Typ. Min. | ISOLATION dB U Typ. Min. | INSERTION LOSS, dB Above 7.8dB L Typ. Max. | INSERTION LOSS, dB Above 7.8dB M° Typ. Max. | INSERTION LOSS, dB Above 7.8dB U Typ. Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | VSWR (:1) S Typ. Max. | VSWR (:1) OUT Typ. Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PSC-6-1 | 1-175 | 30 24 | 26 18 | 26 18 | 0.50 0.80 | 0.70 1.00 | 1.00 1.50 | 4 | 6 | 12 | 0.2 | 0.4 | 0.8 | | | 2-67 | C07 | bk | 74.95 |
| ■ | PSC-6-1-75 | 1-300 | 35 25 | 30 23 | 25 18 | 0.60 1.20 | 0.60 1.10 | 0.60 1.30 | 2 | 4 | 8 | 0.2 | 0.3 | 0.6 | | | 2-65 | C07 | bk | 78.95 |
| | ZC6PD-960 | 890-960 | | 30 20 | | | 0.40 0.80 | | — | — | — | | 0.4 | | 1.20 1.50 | 1.10 1.50 | 2-112 | AB185 | bn | 124.95 |
| | ZC6PD-960W | 700-1000 | | 28 15 | | | 0.40 1.00 | | — | — | — | | 0.6 | | 1.30 1.50 | 1.20 1.50 | 2-112 | AB185 | bn | 119.95 |
| | ZC6PD-1900 | 1700-1900 | | 30 20 | | | 0.40 0.80 | | — | — | — | | 0.5 | | 1.10 1.40 | 1.10 1.50 | 2-113 | AB185 | bn | 134.95 |
| | ZC6PD-1900W | 1500-2000 | | 30 15 | | | 0.50 1.00 | | — | — | — | | 0.6 | | 1.10 1.68 | 1.10 1.50 | 2-113 | AB185 | bn | 129.95 |
| | ZBSC-611 | 10-200 | 28 22 | 26 20 | 23 20 | 0.50 0.80 | 0.70 1.00 | 0.90 1.20 | 4 | 5 | 6 | 0.2 | 0.3 | 0.5 | | | 2-66 | UU102 | bn | 114.95 |
| | ZBSC-615 | 1-500 | 30 25 | 26 18 | 24 18 | 0.50 0.80 | 0.70 1.20 | 1.00 2.20 | 4 | 8 | 20 | 0.2 | 0.4 | 1.2 | | | 2-66 | UU102 | bn | 119.95 |
| | ZB6PD1-900 | 800-900 | | 32 20 | | | 0.30 0.70 | | — | — | — | | 0.5 | | 1.10 1.50 | 1.13 1.35 | 2-114 | UU187 | bn | 139.95 |
| NEW △ | ZB6PD-2 | 800-2000 | | 27 17 | | | 0.70 1.70 | | — | — | — | | 0.7 | | 1.20 1.60 | 1.13 1.30 | — | Z259 | bn | 158.95 |
| | ZB6PD1-960 | 890-960 | | 35 20 | | | 0.30 0.80 | | — | — | — | | 0.6 | | 1.10 1.30 | 1.10 1.30 | 2-114 | UU187 | bn | 139.95 |
| NEW | ZB6PD-1700 | 1500-1700 | | 30 20 | | | 0.50 1.00 | | — | — | — | | 0.6 | | 1.15 1.50 | 1.30 1.50 | — | Z40 | bn | 149.95 |
| | ZB6PD1-1900 | 1700-1900 | | 32 20 | | | 0.40 0.80 | | — | — | — | | 0.6 | | 1.10 1.30 | 1.09 1.40 | 2-115 | UU187 | bn | 149.95 |
| | ZFSC-6-1 | 1-175 | 27 22 | 26 20 | 26 20 | 0.75 1.00 | 0.75 1.20 | 0.80 1.20 | 2 | 6 | 12 | 0.2 | 0.4 | 0.6 | | | 2-67 | Q28 | bn | 99.95 |
| ■ | ZFSC-6-1-75 | 1-200 | 30 25 | 30 22 | 20 18 | 0.75 1.00 | 0.75 1.00 | 0.90 1.20 | 2 | 6 | 12 | 0.2 | 0.4 | 0.6 | | | 2-65 | Q28 | bn | 102.95 |
| | ZFSC-6-110 | 1-500 | 35 25 | 26 20 | 25 20 | 0.50 0.80 | 0.60 1.10 | 1.00 1.70 | 2 | 6 | 12 | 0.3 | 0.3 | 0.8 | | | 2-67 | Q28 | bn | 109.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

## pin and coaxial connections

see case style outline drawing for pin locations

| PORT | bj | bk | bm | bn | gg | hv |
|---|---|---|---|---|---|---|
| SUM PORT | 1 | 1 | S | S (COM) | 1 | 1 |
| PORT 1 | 4 | 3 | 1 | 1 | 3 | 6 |
| PORT 2 | 8 | 4 | 2 | 2 | 8 | 8 |
| PORT 3 | 12 | 8 | 3 | 3 | 12 | 7 |
| PORT 4 | 16 | 12 | 4 | 4 | 16 | 5 |
| PORT 5 | 15 | 16 | 5 | 5 | 15 | 3 |
| PORT 6 | — | 15 | — | 6 | — | — |
| GND EXT. | 2,5,7,11,13,14 | 2,5,7,11,13,14 | — | — | 2,5,7,11,13,14 | 2,4 |
| CASE GND | 2,5,7,11,13,14 | 2,5,7,11,13,14 | — | — | 4,6,9,10 | — |
| NOT USED | 3,6,9,10 | 6,9,10 | — | — | — | — |

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PSC-5-1 | 6625-01-255-3143 |
| ZFSC-6-1(BNC) | 6625-01-225-6965 |
| ZFSC-6-1(SMA) | 6625-01-263-9871 |
| PSC-6-1 | 6625-01-249-8012 |
| ZBSC-615 | 6625-01-391-5026 |

**In Stock... Immediate Delivery**

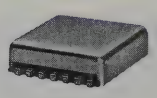
For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

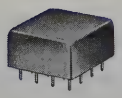
# POWER SPLITTERS/COMBINERS 50 & 75Ω

## 8 WAY-0° 10 kHz to 850 MHz

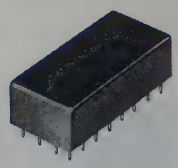
SURFACE MOUNT



JCPS-8



PSC-8



PSC-8A

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB L Min. | ISOLATION dB M° Typ. | ISOLATION dB M° Min. | ISOLATION dB U Typ. | ISOLATION dB U Min. | INSERTION LOSS, dB Above 9dB L Typ. | INSERTION LOSS, dB Above 9dB L Max. | INSERTION LOSS, dB Above 9dB M° Typ. | INSERTION LOSS, dB Above 9dB M° Max. | INSERTION LOSS, dB Above 9dB U Typ. | INSERTION LOSS, dB Above 9dB U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ■ | JCPS-8-850-75 | 10-850 | 34 | 20 | 25 | 15 | 20 | 15 | 0.7 | 1.5 | 1.0 | 2.0 | 1.8 | 3.0 | -- | -- | -- | 0.6 | 0.7 | 1.0 | -- | BG291 | hn | 69.95 |
| | PSC-8-1 | 0.5-175 | 30 | 25 | 30 | 20 | 25 | 18 | 0.8 | 1.2 | 0.8 | 1.2 | 1.0 | 1.6 | 1.0 | 2.5 | 5.0 | 0.2 | 0.3 | 0.5 | 2-68 | C07 | bp | 74.95 |
| NEW | PSC-8-1W | 10-600 | 25 | 20 | 23 | 16 | 20 | 16 | 1.0 | 1.8 | 1.2 | 2.2 | 1.7 | 2.8 | 2.0 | 4.0 | 10.0 | 0.3 | 0.6 | 0.9 | -- | C07 | bp | 109.95 |
| ■ | PSC-8-1-75 | 0.5-175 | 25 | 20 | 30 | 20 | 25 | 20 | 0.5 | 1.0 | 0.6 | 1.1 | 0.7 | 1.3 | 1.0 | 2.5 | 5.0 | 0.2 | 0.2 | 0.3 | 2-73 | C07 | bp | 78.95 |
| ✣ | PSC-8-6 | 0.01-10 | 40 | 20 | 40 | 25 | 28 | 23 | 0.3 | 1.0 | 0.5 | 1.0 | 0.6 | 1.1 | 4.0 | 2.5 | 4.0 | 0.4 | 0.2 | 0.3 | 2-69 | C07 | bp | 93.95 |
| | PSC-8A-4 | 5-500 | 25 | 20 | 23 | 18 | 20 | 15 | 0.7 | 1.2 | 1.0 | 1.8 | 1.4 | 2.5 | 3.0 | 8.0 | 16.0 | 0.2 | 0.3 | 0.5 | 2-68 | E10 | bq | 103.95 |
| ■ | PSC-8A4-75 | 1-300 | 26 | 20 | 30 | 25 | 30 | 23 | 0.8 | 1.2 | 0.7 | 1.1 | 0.9 | 1.3 | 1.0 | 3.0 | 8.0 | 0.2 | 0.2 | 0.4 | 2-72 | E10 | br | 93.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PSC-8-1 | 6625-01-365-5615 |
| ZB8PD-4(SMA) | 5985-01-372-8880 |
| ZFSC-8-1(BNC) | 5820-01-136-7244 |
| ZFSC-8-1(SMA) | 6620-01-223-1235 |
| ZFSC-8-1-75 | 5895-01-326-8664 |
| ZFSC-8-43(SMA) | 6625-01-333-1125 |
| ZFSC-8375 | 5895-01-229-0156 |

### pin connections

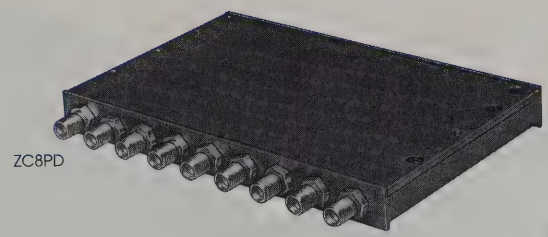
see case style outline drawings

| PORT | SUM | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | NOT USED | GND EXT. | CASE GND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bp | 2 | 1 | 5 | 9 | 13 | 16 | 12 | 8 | 4 | 10,11 | 3,6,7,14,15 | 3,6,7,14,15 |
| bq | 29 | 7 | 16 | 31 | 24 | 9 | 2 | 26 | 17 | 4,5,15 | -- | All other pins |
| br | 29 | 7 | 16 | 31 | 24 | 9 | 2 | 26 | 17 | 15 | -- | All other pins |
| hn | 1 | 3 | 4 | 5 | 6 | 9 | 10 | 11 | 12 | -- | 2,7,8,13,14 | 2,7,8,13,14 |

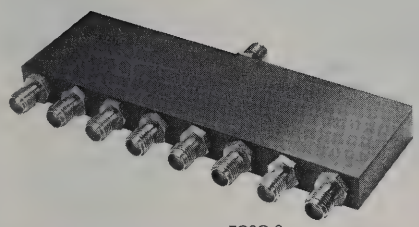


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

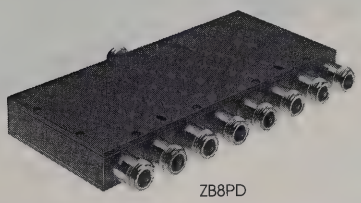
# 10 kHz to 8.4 GHz



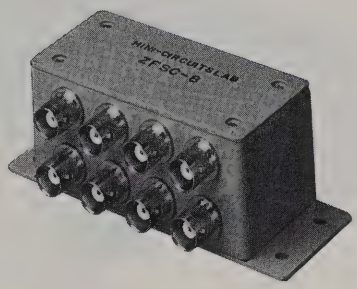
ZC8PD



ZCSC-8



ZB8PD



ZFSC-8

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | ISOLATION dB L Min. | ISOLATION dB M° Typ. | ISOLATION dB M° Min. | ISOLATION dB U Typ. | ISOLATION dB U Min. | INSERTION LOSS, dB Above 9dB L Typ. | INSERTION LOSS, dB Above 9dB L Max. | INSERTION LOSS, dB Above 9dB M° Typ. | INSERTION LOSS, dB Above 9dB M° Max. | INSERTION LOSS, dB Above 9dB U Typ. | INSERTION LOSS, dB Above 9dB U Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZC8PD-900* | 800-900 | | | 30 | 20 | | | | | 0.4 | 0.7 | | | | 5.0 | | | 0.4 | | 2-115 | AB186 | — | 158.95 |
| ZCSC-8-1 | 2-250 | 37 | 27 | 30 | 20 | 24 | 18 | 0.65 | 1.2 | 0.8 | 1.2 | 1.0 | 1.6 | 2.0 | 4.0 | 8.0 | 0.2 | 0.3 | 0.5 | — | UU215 | — | 119.95 |
| ZFSC-8-1 | 0.5-175 | 30 | 25 | 30 | 20 | 25 | 18 | 0.8 | 1.2 | 0.8 | 1.2 | 1.0 | 1.6 | 1.0 | 2.5 | 5.0 | 0.2 | 0.2 | 0.3 | 2-68 | R29 | — | 99.95 |
| ■ ZFSC-8-1-75 | 0.5-175 | 25 | 20 | 30 | 20 | 25 | 20 | 0.5 | 1.0 | 0.6 | 1.1 | 0.7 | 1.3 | 1.0 | 2.5 | 5.0 | 0.2 | 0.3 | 0.5 | 2-73 | R29 | — | 102.95 |
| ■ ZFSC-82-75 | 10-900 | 35 | 17 | 23 | 17 | 20 | 15 | 0.6 | 0.9 | 0.9 | 1.6 | 1.6 | 2.7 | 2.0 | 4.0 | 10.0 | 0.2 | 0.5 | 1.2 | 2-73 | R29 | — | 139.95 |
| ■ ZFSC-84-75 | 1-300 | 26 | 20 | 30 | 25 | 30 | 23 | 0.8 | 1.5 | 0.7 | 1.1 | 0.9 | 1.5 | 4.0 | 3.0 | 8.0 | 0.2 | 0.2 | 0.4 | 2-72 | R29 | — | 119.95 |
| ■ ZFSC-8375 | 50-90 | 30 | 25 | 30 | 25 | 25 | 25 | 1.0 | 1.0 | 1.0 | 1.3 | 1.3 | 1.3 | 2.0 | 2.0 | 2.0 | 0.2 | 0.2 | 0.2 | 2-72 | R29 | — | 119.95 |
| ZFSC-8-4 | 5-700 | 35 | 20 | 25 | 17 | 20 | 17 | 0.8 | 1.2 | 1.2 | 1.8 | 1.8 | 2.5 | 2.0 | 5.0 | 15.0 | 0.2 | 0.4 | 0.7 | 2-70 | R29 | — | 128.95 |
| ZFSC-8-43 | 10-1000 | 23 | 20 | 25 | 20 | 26 | 20 | 1.0 | 1.6 | 1.4 | 2.1 | 2.1 | 2.9 | 5.0 | 10.0 | 20.0 | 0.2 | 0.4 | 0.7 | 2-70 | R29 | — | 138.95 |
| ✣ ZFSC-8-6 | 0.01-10 | 35 | 20 | 40 | 25 | 35 | 25 | 0.3 | 1.0 | 0.2 | 0.6 | 0.3 | 0.7 | 4.0 | 2.0 | 3.0 | 0.4 | 0.2 | 0.3 | 2-69 | R29 | — | 109.95 |
| ZB8PD-1** | 800-960 | | | 30 | 20 | | | | | 0.4 | 0.9 | | | | 8.0 | | | 0.4 | | — | Z40 | — | 138.95 |
| ZB8PD-2 | 1000-2000 | | | 24 | 17 | | | | | 0.8 | 1.3 | | | | 18.0 | | | 0.8 | | 2-71 | Z40 | — | 138.95 |
| ZB8PD-4 | 2000-4200 | | | 23 | 16 | | | | | 0.8 | 1.8 | | | | 10.0 | | | 1.2 | | 2-71 | Z40 | — | 138.95 |
| ZB8PD-8.4 | 7200-8400 | | | 25 | 20 | | | | | 0.9 | 1.6 | | | | 15.0 | | | 0.8 | | — | Z41 | — | 149.95 |
| NEW △ ZB8PD-2000*** | 800-2000 | | | 26 | 18 | | | | | 0.8 | 1.7 | | | | — | | | 0.7 | | — | Z40 | — | 149.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

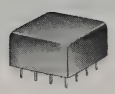
NOTES:

❑ Non-hermetic
* VSWR, input 1.06:1 typical, 1.2:1 max; output 1.17:1 typical, 1.35:1 max
** VSWR, input 1.22:1 typical, 1.5:1 max; output 1.11:1 typical, 1.30:1 max
*** VSWR, input 1.25:1 typical, 1.8:1 max; output 1.10:1 typical 1.40:1 max
✣ Below 0.1 MHz power handling decrease as to typically 15 dBm at 0.01 MHz, 23 dBm at 0.025 Mhz, and 29 dBm at 0.05 MHz.
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
✪ When only specification for M range given, specification applies to entire frequency range.
△ Available only with SMA connectors.
A. General Quality Control Procedures, Environmental Specifications, HI-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Matched power rating,
Models ZB8PD, ZC8PD 10 Watt
All other models, 1 Watt
1b. Internal load dissipation,
Models JCPS, ZB8PD, ZC8PD 0.875 Watt
All other models, 0.62 Watt

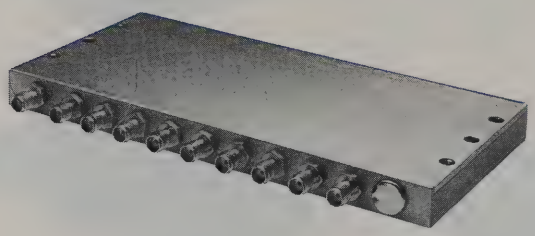
In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.
Available Tape & Reel

# POWER SPLITTERS/COMBINERS 50Ω Plug-In & Coaxial

## 9 WAY-0° 2 to 1000 MHz



PSC-9



ZC9PD

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M° Typ. | M° Min. | U Typ. | U Min. | INSERTION LOSS, dB Above 9.6dB L Typ. | L Max. | M° Typ. | M° Max. | U Typ. | U Max. | PHASE UNBALANCE Degrees L Max. | M° Max. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M° Max. | U Max. | VSWR (:1) S Typ. | S Max. | OUT Typ. | OUT Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PSC-9-1 | 2-300 | 38 | 25 | 26 | 20 | 22 | 15 | 0.6 | 1.1 | 0.9 | 1.4 | 1.5 | 2.0 | 2.0 | 5.0 | 10.0 | 0.2 | 0.3 | 0.8 | — | — | — | — | — | C07 | gr | 93.95 |
| ZC9PD-1000 | 800-1000 | | | 30 | 20 | | | | | 0.6 | 1.2 | | | — | | | | 0.6 | | 1.22 | 1.60 | 1.11 | 1.30 | — | AB204 | — | 169.95 |

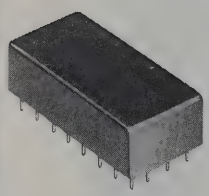
L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

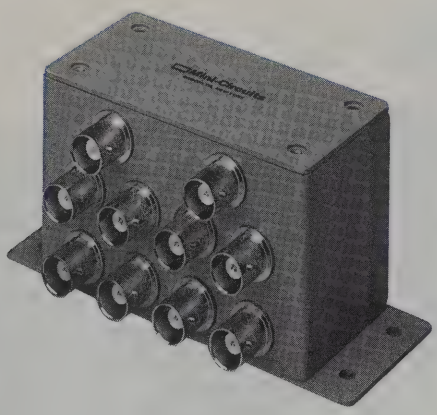
* VSWR, input 1.2: typical, 1.6:1 max; output 1.2:1 typical, 1.35:1 max.
✪ When only specification for M range given, specification applies to entire frequency range.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating,
   Models PSC-9-1, ZC9PD-1000 0.5 Watt
   Model ZC10PD 10 Watt
   All other models 1 Watt
   1b. Internal load dissipation,
   Models PSC-9-1, ZC9PD-1000, ZC10PD 1.5 Watt
   All other models 0.87 Watt


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

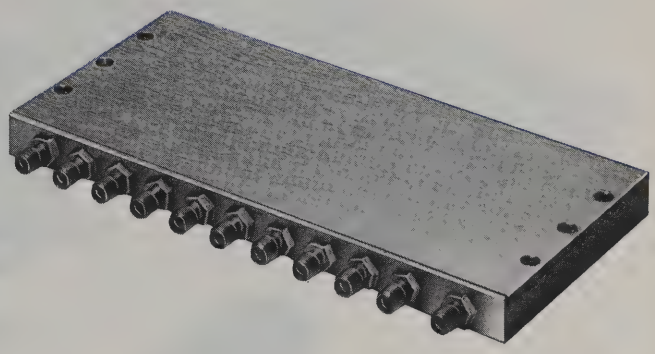
# 10 WAY-0° 0.5 to 900 MHz



PSC-10



ZFSC-10



ZC10PD

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. Min. | ISOLATION dB M° Typ. Min. | ISOLATION dB U Typ. Min. | INSERTION LOSS, dB Above 10dB L Typ. Max. | INSERTION LOSS, dB Above 10dB M° Typ. Max. | INSERTION LOSS, dB Above 10dB U Typ. Max. | PHASE UNBALANCE Degrees L Max. | PHASE UNBALANCE Degrees M° Max. | PHASE UNBALANCE Degrees U Max. | AMPLITUDE UNBALANCE dB L Max. | AMPLITUDE UNBALANCE dB M° Max. | AMPLITUDE UNBALANCE dB U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC-10-1 | 1-150 | 36 23 | 27 23 | 23 18 | 0.3 0.6 | 0.4 0.8 | 1.0 1.3 | 1 | 4 | 10 | 0.1 | 0.2 | 0.3 | 2-74 | E10 | bs | 85.95 |
| SC-10-1 | 0.5-100 | 28 20 | 30 24 | 27 20 | 0.5 0.8 | 0.4 1.0 | 0.8 1.5 | 2 | 6 | 10 | 0.2 | 0.3 | 0.4 | 2-74 | RR93 | — | 119.95 |
| C10PD-900 | 800-900 | | 25 20 | | | 1.5 2.0 | | | — | | | 0.8 | | 2-120 | AB204 | — | 178.95 |
| C10PD-900W* | 750-900 | | 30 20 | | | 0.4 1.0 | | | — | | | 0.6 | | — | AB204 | — | 189.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

## pin connections

see case style outline drawings for pin locations

| PORT | SUM | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | NOT USED | GND EXT. | CASE GND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bs | 29 | 7 | 16 | 31 | 24 | 9 | 2 | 26 | 17 | 4 | 5 | 15 | All other pins | All other pins |
| gr | 1 | 9 | 13 | 14 | 15 | 16 | 12 | 8 | 4 | 3 | — | — | All other pins | All other pins |

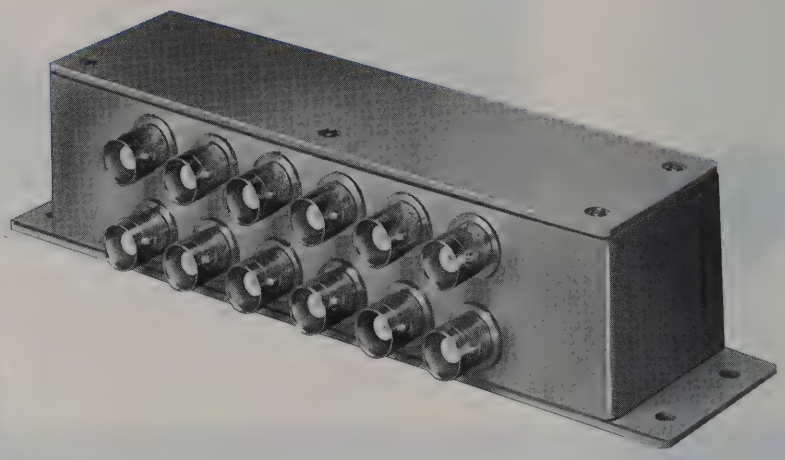
CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# 12 WAY-0° 1 to 500 MHz

PSC-12



ZFSC-12

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 10.8dB | | | | | | PHASE UNBALANCE Degrees | | | AMPLITUDE UNBALANCE dB | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M | | U | | L | | M | | U | | L | M | U | L | M | U | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Page | Note B | | Qty. (1-9) |
| PSC-12-1 | 1-200 | 35 | 30 | 27 | 20 | 21 | 18 | 0.5 | 0.8 | 0.8 | 1.2 | 1.0 | 1.4 | 4 | 8 | 16 | 0.2 | 0.4 | 0.7 | 2-75 | E10 | bu | 88.95 |
| ZFSC-12-1 | 1-200 | 30 | 25 | 35 | 20 | 28 | 20 | 0.8 | 1.2 | 1.1 | 1.4 | 1.3 | 1.6 | 4 | 8 | 16 | 0.3 | 0.2 | 0.3 | 2-75 | R67 | — | 174.95 |
| ZFSC-12-11 | 10-300 | 28 | 20 | 33 | 25 | 28 | 20 | 1.1 | 1.3 | 1.1 | 1.5 | 1.5 | 1.8 | 2 | 4 | 6 | 0.2 | 0.3 | 0.4 | 2-75 | R67 | — | 174.95 |
| ■ ZFSC-12-1-75 | 10-200 | 35 | 27 | — | — | 27 | 20 | 0.5 | 0.8 | — | — | 0.8 | 1.3 | — | — | — | 0.25 | — | 0.4 | 2-76 | R67 | — | 179.95 |
| ■ ZFSC-12-175 | 10-500 | 23 | 20 | 24 | 20 | 22 | 18 | 0.9 | 1.2 | 1.0 | 1.3 | 1.2 | 2.0 | — | — | — | 0.4 | 0.5 | 0.8 | 2-76 | R67 | — | 197.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

✪ When only specification for M range given, specification applies to entire frequency range.

✣ At low range frequency band ($f_L$ to 10 $f_L$), linearly derate maximum input power by 13 dB.

* For adjacent ports, isolation is 28 dB minimum.
Adjacent ports defined as: (1,3) (5,7) (9,11) (13,15)
(2,4) (6,8) (10,12) (14,16)

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating,
   Model ZC16PD 10 Watt
   All other models 1 Watt
   1b. Internal load dissipation,
   Model ZC16PD 2.4 Watt
   Model ZC16PD-2185 1.75 Watt
   All other models 0.87 Watt

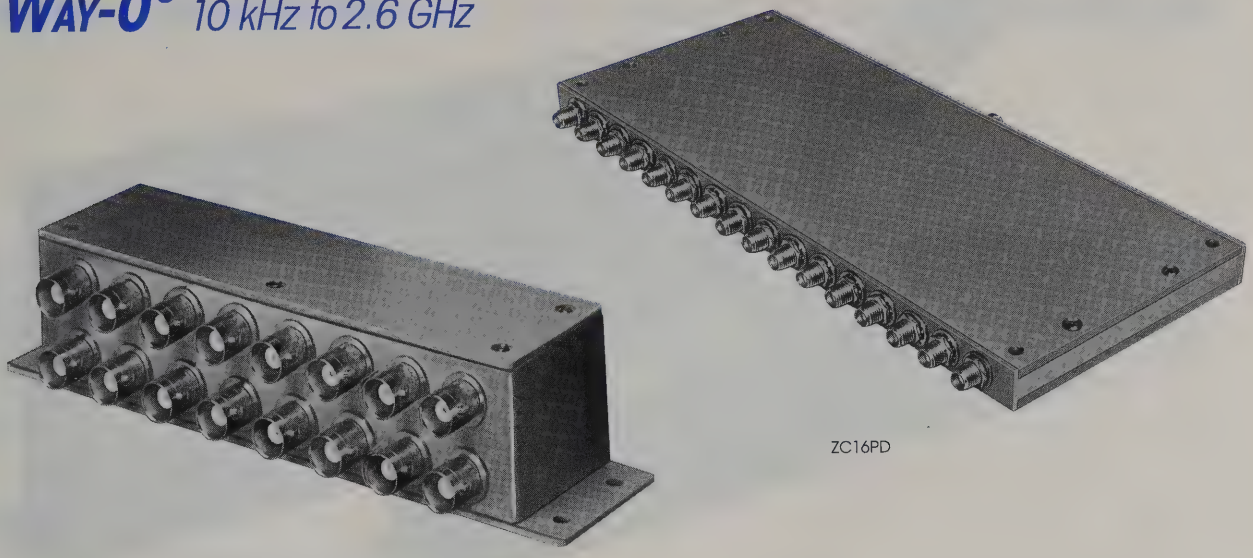
## NSN GUIDE

| MCL NO. | NSN |
|---|---|
| ZFSC-16-1(BNC) | 5820-01-9321 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 16 WAY-0° 10 kHz to 2.6 GHz



ZC16PD

ZFSC-16

| MODEL NO. | FREQ. RANGE MHz | ISOLATION dB | | | | | | INSERTION LOSS, dB Above 12dB | | | | | | PHASE UNBALANCE Degrees | | | AMPLITUDE UNBALANCE dB | | | VSWR (:1) | | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | connection | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | | M° | | U | | L | | M° | | U | | L | M° | U | L | M° | U | S | | OUT | | | | | |
| | $f_L$-$f_U$ | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Max. | Max. | Max. | Max. | Max. | Max. | Typ. | Max. | Typ. | Max. | Page | Note B | | Qty. (1-9) |
| ZFSC-16-1 | 0.5-125 | 30 | 24 | 25 | 18 | 20 | 15 | 1.0 | 1.2 | 1.1 | 1.3 | 1.2 | 1.4 | 1 | 3 | 5 | 0.3 | 0.2 | 0.5 | see | | | | 2-78 | R30 | — | 172.95 |
| ■ ZFSC-16-1-75 | 1-150 | 30 | 25 | 30 | 25 | 25 | 20 | 0.8 | 1.1 | 0.7 | 1.1 | 1.0 | 1.3 | 3 | 6 | 10 | 0.4 | 0.2 | 0.4 | | | | | 2-77 | R30 | — | 182.95 |
| ZFSC-16-3* | 1-30 | 45 | 35 | 45 | 40 | 41 | 35 | 0.5 | 0.9 | 0.5 | 0.9 | 0.5 | 0.9 | 1 | 2 | 3 | 0.1 | 0.1 | 0.1 | Performance | | | | 2-78 | R30 | — | 172.95 |
| ■ ZFSC-16-675 | 0.01-25 | 25 | 20 | 40 | 25 | 25 | 20 | 0.8 | 1.1 | 0.4 | 0.8 | 1.0 | 1.6 | 1 | 3 | 5 | 0.1 | 0.2 | 0.4 | | | | | 2-77 | R30 | — | 189.95 |
| ZFSC-16-12 | 0.1-200 | 33 | 20 | 27 | 20 | 26 | 20 | 0.6 | 1.5 | 0.7 | 1.0 | 0.9 | 1.5 | 2 | 6 | 9 | 0.4 | 0.2 | 0.4 | Data and | | | | 2-79 | R30 | — | 189.95 |
| | | | | | | | | | | | | | | | | | | | | curves | | | | | | | |
| ZC16PD-900 | 800-900 | | | 30 | 20 | | | | | 0.5 | 1.0 | | | | | | | 0.5 | | 1.06 | 1.20 | 1.06 | 1.20 | 2-117 | UU179 | — | 295.00 |
| ZC16PD-960 | 890-960 | | | 28 | 20 | | | | | 0.5 | 1.0 | | | | | | | 0.5 | | 1.06 | 1.30 | 1.06 | 1.20 | 2-116 | UU179 | — | 295.00 |
| ZC16PD-960W | 700-1000 | | | 26 | 15 | | | | | 0.5 | 1.3 | | | | | | | 0.6 | | 1.10 | 1.60 | 1.06 | 1.30 | 2-116 | UU179 | — | 265.00 |
| ZC16PD-1900 | 1700-1900 | | | 30 | 20 | | | | | 0.5 | 1.0 | | | | | | | 0.8 | | 1.15 | 1.35 | 1.06 | 1.30 | 2-117 | UU179 | — | 349.00 |
| ZC16PD-1900W | 1500-2100 | | | 30 | 15 | | | | | 0.7 | 1.4 | | | | | | | 0.8 | | 1.25 | 1.60 | 1.15 | 1.35 | — | UU179 | — | 319.00 |
| W ZC16PD-2185 | 1800-2600 | | | 30 | 16 | | | | | 0.5 | 1.4 | | | | 6 | | | 0.7 | | 1.15 | 1.60 | 1.05 | 1.30 | — | UU179 | — | 319.00 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

pin connections see case style outline drawings

| PORT | SUM | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 | NOT USED | GND EXT. | CASE GND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bu | 5 | 7 | 8 | 1 | 2 | 31 | 32 | 25 | 26 | 22 | 30 | 19 | 27 | 11,14,21 | 4 | All other pins |

CAPD now available! computer-automated performance data

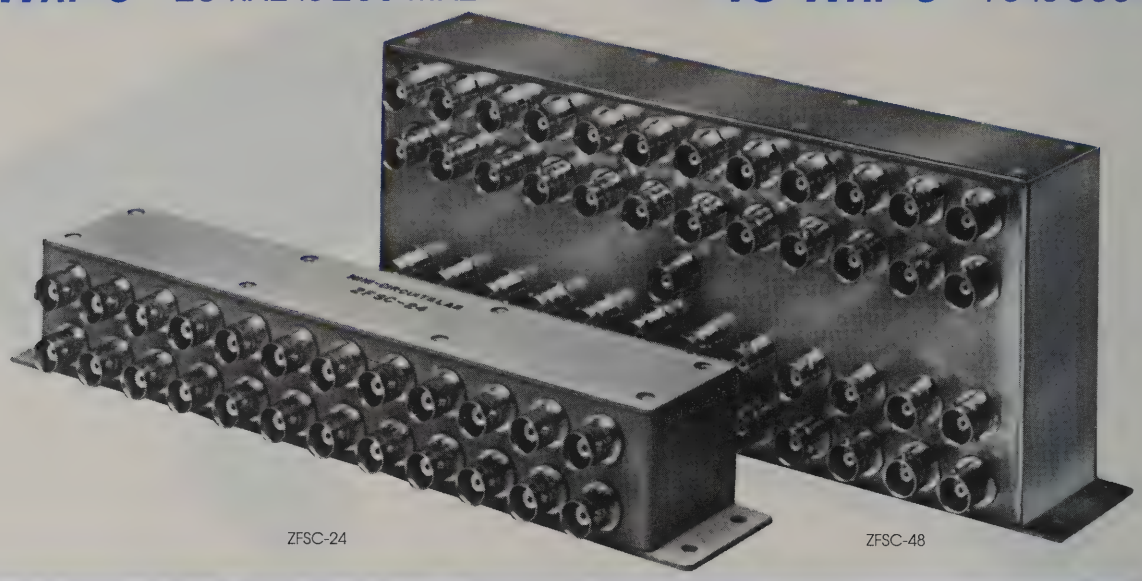
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# POWER SPLITTERS/COMBINERS 50 & 75Ω

## 24 WAY-0° 25 kHz to 200 MHz

## 48 WAY-0° 10 to 300 MHz



ZFSC-24 ZFSC-48

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | ISOLATION dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | INSERTION LOSS, dB 24 WAY (above 13.8dB) 48 WAY (above 16.8dB) L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | AMPLITUDE UNBALANCE dB L Max. | M Max. | U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZFSC-24-1 | 0.2-100 | 25 | 20 | 25 | 20 | 25 | 20 | 1.0 | 2.0 | 1.0 | 2.0 | 1.0 | 2.0 | 0.2 | 0.4 | 0.5 | 2-80 | R31 | — | 264.95 |
| ZFSC-24-11 | 1-200 | 33 | 25 | 22 | 20 | 20 | 17 | 0.9 | 1.7 | 1.0 | 1.8 | 1.3 | 2.2 | 0.2 | 0.8 | 0.8 | 2-80 | R31 | — | 274.95 |
| ■ ZFSC-24-11-75 | 1-200 | 35 | 25 | 33 | 20 | 27 | 20 | 0.6 | 1.3 | 0.8 | 1.5 | 1.1 | 2.0 | 0.2 | 0.4 | 0.6 | — | R31 | — | 274.95 |
| ✣ ZFSC-24-6 | 0.025-50 | 30 | 25 | 39 | 28 | 30 | 22 | 0.4 | 1.0 | 0.4 | 1.0 | 0.6 | 1.5 | 0.2 | 0.3 | 0.7 | 2-81 | R31 | — | 274.95 |
| ZFSC-48-1 | 10-300 | 30 | 25 | 28 | 20 | 23 | 20 | 1.2 | 2.0 | 2.1 | 2.5 | 2.8 | 4.0 | 0.6 | 0.7 | 1.0 | 2-82 | HH68 | — | 590.00 |
| ■ ZFSC-48-1-75 | 10-300 | 30 | 25 | 28 | 20 | 23 | 20 | 1.2 | 2.0 | 2.1 | 2.5 | 2.8 | 4.0 | 0.6 | 0.7 | 1.0 | 2-82 | HH68 | — | 590.00 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

✣ At low range frequency band ($f_L$ to 10 $f_L$), linearly derate maximum input power by 13 dB.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating, 1 Watt
   1b. Internal load dissipation, 0.87 Watt



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# MATCHING PAD *Coaxial*

Mini-Circuits®

## MINIMUM LOSS *DC to 2000 MHz, 50 to 75Ω*

BMP

| MODEL NO. | FREQUENCY RANGE, MHz | | ATTENUATION dB | | | | VSWR max. | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTOR | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flatness max. | | | | | | | | | Qty. (1-9) |
| | $f_L$ | $f_U$ | Nom. | L | M | U | L | M | U | Page | Note B | | |
| BMP-5075 | DC | 2000 | 5.7±0.1 | 0.2 | 0.3 | 0.4 | 1.06:1 | 1.22:1 | 1.4:1 | — | FF55 | 75ΩM-BNC 50ΩF-BNC | 24.95 |
| BMP-5075R | DC | 2000 | 5.7±0.1 | 0.2 | 0.3 | 0.4 | 1.06:1 | 1.22:1 | 1.4:1 | — | FF55 | 50ΩM-BNC 75ΩF-BNC | 24.95 |

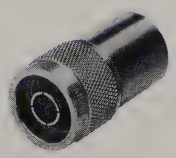
L=DC to 100MHz M=100MHz to 1000MHz U=1000MHz to 2000MHz

features

- minimum loss pad for resistive matching of 75 ohm impedance to 50 ohms and vice versa
- excellent VSWR 1.15:1 Typical

# TERMINATIONS *50&75Ω Coaxial*

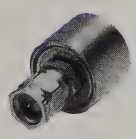
## *DC to 2000 MHz*



NTRM

TTRM (Consult Factory)

BTRM



STRM

| MODEL NO. | IMPEDANCE OHMS | FREQUENCY RANGE, MHz | RETURN LOSS, dB, MIN. | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTOR | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|
| | | | DC-500 | DC-1000 | DC-2000 | Page | Note B | | Qty. (1-9) |
| BTRM-50 | 50 | DC-2000 | 35 | 30 | 21 | 6-10 | LL85 | M-BNC | 8.25 |
| ■ BTRM-75 | 75 | DC-1000 | 30 | 20 | — | 6-10 | LL85 | M-BNC, 75Ω | 9.95 |
| STRM-50 | 50 | DC-2000 | 35 | 30 | 21 | 6-10 | LL86 | M-SMA | 9.45 |
| NTRM-50 | 50 | DC-2000 | 35 | 30 | 21 | 6-10 | LL87 | M-TYPE N | 9.45 |

NOTES:

■ Denotes 75 ohm model, for coax connector models 75 ohm BNC connectors are standard.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
1a. RF input power, 0.25 Watt for BMP-5075 and all terminations.

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| BTRM-50 | 6625-01-325-7972 |
| BTRM-75 | 5985-01-328-7420 |

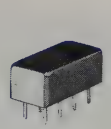
CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

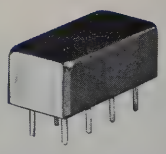
For Custom Versions Of Standard Models Consult Our Applications Dept.

# FIXED ATTENUATORS 50 & 75 Ω Plug-In

## 1/2W, 1W 1 to 40 dB, DC to 2000 MHz



MAT



AT

| MODEL NO. | FREQUENCY RANGE, MHz $f_L$-$f_U$ | ATTENUATION dB Nom. | FLATNESS, MAX. L | M | U | VSWR max. L | M | U | POWER,W | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAT-1 | DC-1500 | 1±0.2 | 0.3 | 0.4 | 0.5 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | A11 | cr | 4.45 |
| MAT-2 | DC-1500 | 2±0.2 | 0.3 | 0.4 | 0.8 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | A11 | cr | 4.45 |
| MAT-3 | DC-1500 | 3±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | A11 | cr | 4.45 |
| MAT-4 | DC-1500 | 4±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | A11 | cr | 4.45 |
| MAT-5 | DC-1500 | 5±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | A11 | cr | 4.45 |
| MAT-6 | DC-1500 | 6±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | | 6-7 | A11 | cr | 4.45 |
| MAT-7 | DC-1500 | 7±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | A11 | cr | 4.45 |
| MAT-8 | DC-1500 | 8±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | A11 | cr | 4.45 |
| MAT-9 | DC-1500 | 9±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | A11 | cr | 4.45 |
| MAT-10 | DC-1500 | 10±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | A11 | cr | 4.45 |
| MAT-12 | DC-1500 | 12±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | A11 | cr | 4.45 |
| MAT-15 | DC-1500 | 15±0.4 | 0.4 | 0.7 | 1.1 | 1.3 | 1.5 | 1.7 | 0.5 | 6-9 | A11 | cr | 4.45 |
| MAT-20 | DC-1500 | 20±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 0.5 | 6-9 | A11 | cr | 4.45 |
| MAT-25 | DC-1500 | 25±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 0.5 | — | A11 | cr | 4.45 |
| MAT-30 | DC-1000 | 30±0.5 | 0.5 | 1.0 | — | 1.3 | 1.6 | — | 0.5 | 6-9 | A11 | cr | 4.45 |
| MAT-40 | DC-500 | 40±0.6 | 1.0 | — | — | 1.5 | — | — | 0.5 | 6-9 | A11 | cr | 4.45 |
| AT-1 | DC-1500 | 1±0.2 | 0.3 | 0.4 | 0.5 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | A04 | cr | 3.65 |
| AT-2 | DC-1500 | 2±0.2 | 0.3 | 0.4 | 0.8 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | A04 | cr | 3.65 |
| AT-3 | DC-1500 | 3±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | A04 | cr | 3.65 |
| ■ AT-3-75 | DC-500 | 3±0.2 | 0.9 | — | — | 2.0 | — | — | 1 | 6-6 | A04 | cr | 3.65 |
| AT-4 | DC-1500 | 4±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | A04 | cr | 3.65 |
| AT-5 | DC-1500 | 5±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | A04 | cr | 3.65 |
| AT-6 | DC-1500 | 6±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | A04 | cr | 3.65 |
| ■ AT-6-75 | DC-500 | 6±0.3 | 1.0 | — | — | 2.0 | — | — | 1 | 6-7 | A04 | cr | 3.65 |
| AT-7 | DC-1500 | 7±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | A04 | cr | 3.65 |
| AT-8 | DC-1500 | 8±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | A04 | cr | 3.65 |
| AT-9 | DC-1500 | 9±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | A04 | cr | 3.65 |
| AT-10 | DC-1500 | 10±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | A04 | cr | 3.65 |
| ■ AT-10-75 | DC-500 | 10±0.4 | 1.0 | — | — | 2.0 | — | — | 1 | 6-8 | A04 | cr | 3.65 |
| AT-12 | DC-1500 | 12±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | A04 | cr | 3.65 |
| AT-15 | DC-1500 | 15±0.4 | 0.4 | 0.7 | 1.1 | 1.3 | 1.5 | 1.7 | 1 | 6-9 | A04 | cr | 3.65 |
| ■ AT-15-75 | DC-500 | 15±0.4 | 0.8 | — | — | 1.5 | — | — | 1 | 6-9 | A04 | cr | 3.65 |
| AT-20 | DC-1500 | 20±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 1 | 6-9 | A04 | cr | 3.65 |
| ■ AT-20-75 | DC-500 | 20±0.5 | 1.1 | — | — | 2.0 | — | — | 1 | 6-9 | A04 | cr | 3.65 |
| AT-25 | DC-2000 | 25±0.5 | 0.4 | 0.8 | 1.3* | 1.3 | 1.6 | 1.8** | 1 | — | A04 | cr | 3.65 |
| AT-30 | DC-1000 | 30±0.5 | 0.5 | 1.0 | — | 1.3 | 1.6 | — | 1 | 6-9 | A04 | cr | 3.65 |
| AT-40 | DC-500 | 40±0.6 | 1.0 | — | — | 1.5 | — | — | 1 | 6-9 | A04 | cr | 3.65 |

L = DC-500 MHz M = DC-1000 MHz U = DC-$f_U$

NOTES:

❑ Non-hermetic
■ Denotes 75 ohm models.
* Attenuation Flatness over DC-2000 MHz: 0.75 dB typ.
** VSWR over DC-2000 MHz: 1.45 (typ.)
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
For PAT models:
1. RF power at 25° C case temp.: 1 Watt.
2. Attenuation and VSWR at 25° C case temp.

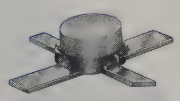
**NSN GUIDE**

| MCL NO. | NSN | | |
|---|---|---|---|
| AT-6 | 5985-01-275-0339 | MAT-3 | 5985-01-274-6609 |
| MAT-1 | 5985-01-265-8138 | MAT-4 | 5985-01-326-6977 |
| MAT-10 | 5985-01-294-4719 | MAT-5 | 5985-01-336-3720 |
| MAT-15 | 5985-01-294-4720 | MAT-6 | 5985-01-295-0261 |
| MAT-2 | 5985-01-336-3058 | MAT-7 | 5985-01-326-6978 |
| MAT-20 | 5985-01-294-4721 | MAT-9 | 5985-01-332-4595 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 1W MINIATURE CERAMIC 1 to 30 dB, DC to 7000 MHz



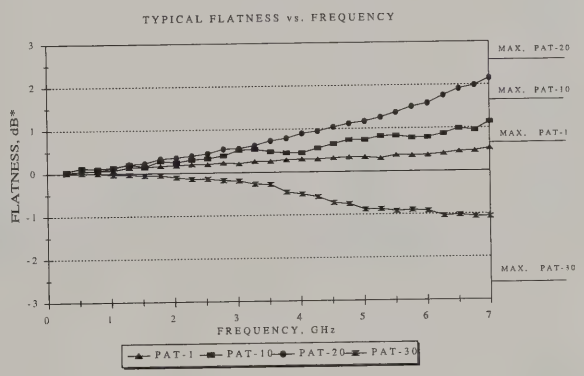
PAT

| MODEL NO. | FREQUENCY RANGE, MHz $f_L$-$f_U$ | ATTENUATION dB Nom. | FLATNESS, MAX. L | M | U | VSWR max. L | M | U | POWER,W | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (10-49) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PAT-1 | DC-7000 | 1±0.2 | 0.3 | 0.4 | 0.7 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-2 | DC-7000 | 2±0.2 | 0.3 | 0.5 | 0.9 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-3 | DC-7000 | 3±0.3 | 0.3 | 0.5 | 0.9 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-4 | DC-7000 | 4±0.3 | 0.3 | 0.5 | 0.9 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-5 | DC-7000 | 5±0.3 | 0.3 | 0.5 | 1.0 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-6 | DC-7000 | 6±0.3 | 0.3 | 0.5 | 1.1 | 1.2 | 1.3 | 1.4 | 1 | --- | AF320 | hl | 2.95 |
| PAT-7 | DC-7000 | 7±0.3 | 0.4 | 0.6 | 1.3 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-8 | DC-7000 | 8±0.4 | 0.4 | 0.6 | 1.5 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-9 | DC-7000 | 9±0.4 | 0.4 | 0.6 | 1.7 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-10 | DC-7000 | 10±0.4 | 0.4 | 0.6 | 1.7 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-12 | DC-7000 | 12±0.6 | 0.5 | 0.6 | 1.8 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-15 | DC-7000 | 15±0.6 | 0.5 | 0.7 | 2.4 | 1.3 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-20 | DC-7000 | 20±1.3 | 0.5 | 0.7 | 2.6 | 1.4 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |
| PAT-30 | DC-7000 | 30±1.7 | 0.4 | 0.7 | 2.6 | 1.4 | 1.4 | 1.5 | 1 | --- | AF320 | hl | 2.95 |

L = DC-1000 MHz  M = DC-2500 MHz  U = DC-$f_U$

## features

- low-cost ceramic package.
- wideband DC - 7 GHz frequency coverage.
- excellent VSWR throughout entire band.
- miniature size.




## pin connections

see case style outline drawings

| PORT | cr | hi |
|---|---|---|
| INPUT | 1 | 1 |
| OUTPUT | 8 | 3 |
| GND | 2,3,4,5,6,7 | 2,4 |

* 0 dB on Flatness graph corresponds to actural low-frequency attenuation value.

## marking code:

2 digits for nominal attenuation value.
examples: 03 for PAT-3, 20 for PAT-20

## designers kits available

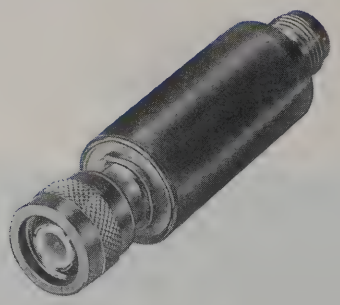
| KIT NO. | MODEL TYPE | No. of Units in Kit | DESCRIPTION | PRICE $ per kit |
|---|---|---|---|---|
| K1-PAT | PAT | 20 | 4 of each 3, 6, 10, 15, 20 | 49.95 |

**In Stock... Immediate Delivery**

For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

## 1/2W, 1W, 2W 0.5 to 40 dB, DC to 2000 MHz



TAT (Consult factory)

CAT

| | MODEL NO. | FREQUENCY RANGE, MHz $f_L$-$f_U$ | ATTENUATION dB Nom. | FLATNESS, MAX. L | M | U | VSWR max. L | M | U | POWER, W | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CAT-1 | DC-1500 | 1±0.2 | 0.3 | 0.4 | 0.5 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF55 | - | 16.95 |
| | CAT-2 | DC-1500 | 2±0.2 | 0.3 | 0.4 | 0.8 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF55 | - | 16.95 |
| | CAT-3 | DC-1500 | 3±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF55 | - | 16.95 |
| ■ | CAT-3-75 | DC-500 | 3±0.2 | 0.9 | — | — | 2.0 | — | — | 1 | 6-6 | FF55 | - | 16.95 |
| | CAT-4 | DC-1500 | 4±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF55 | - | 16.95 |
| | CAT-5 | DC-1500 | 5±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF55 | - | 16.95 |
| | CAT-6 | DC-1500 | 6±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF55 | - | 16.95 |
| ■ | CAT-6-75 | DC-500 | 6±0.3 | 1.0 | — | — | 2.0 | — | — | 1 | 6-7 | FF55 | - | 16.95 |
| | CAT-7 | DC-1500 | 7±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF55 | - | 16.95 |
| | CAT-8 | DC-1500 | 8±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF55 | - | 16.95 |
| | CAT-9 | DC-1500 | 9±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF55 | - | 16.95 |
| | CAT-10 | DC-1500 | 10±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF55 | - | 16.95 |
| ■ | CAT-10-75 | DC-500 | 10±0.4 | 1.0 | — | — | 2.0 | — | — | 1 | 6-8 | FF55 | - | 16.95 |
| | CAT-12 | DC-1500 | 12±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF55 | - | 16.95 |
| | CAT-15 | DC-1500 | 15±0.4 | 0.4 | 0.7 | 1.1 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF55 | - | 16.95 |
| ■ | CAT-15-75 | DC-500 | 15±0.4 | 0.8 | — | — | 1.5 | — | — | 1 | 6-9 | FF55 | - | 16.95 |
| | CAT-20 | DC-1500 | 20±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 1 | 6-9 | FF55 | - | 16.95 |
| ■ | CAT-20-75 | DC-500 | 20±0.5 | 1.1 | — | — | 2.0 | — | — | 1 | 6-9 | FF55 | - | 16.95 |
| NEW | CAT-25 | DC-2000 | 25±0.5 | 0.4 | 0.8 | 1.3* | 1.3 | 1.6 | 2.0** | 1 | — | FF55 | - | 16.95 |
| | CAT-30 | DC-1000 | 30±0.5 | 0.5 | 1.0 | — | 1.3 | 1.6 | — | 1 | 6-9 | FF55 | - | 16.95 |
| | CAT-40 | DC-500 | 40±0.6 | 1.0 | — | — | 1.5 | — | — | 1 | 6-9 | FF55 | - | 16.95 |

L = DC-500 MHz M = DC-1000 MHz U = DC-$f_U$

NOTES:

■ Denotes 75 ohm models. For coax connector models 75 ohm BNC connectors are standard.

* Attenuation Flatness over DC-2000 MHz:
CAT-25, NAT-25, 0.75 dB typ.; NAT-1-2W, 0.20 dB typ.;
NAT-2-2W, 0.40 dB typ.; NAT-3-2W, 0.50 dB typ.

** VSWR over DC-2000 MHz:
CAT-25, NAT-25, 1.45 (typ.)
NAT-2W models, 1.25 (typ.)

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

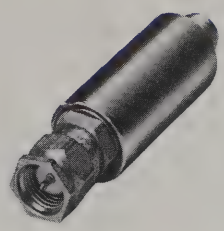
**NSN GUIDE**

| MCL NO. | NSN | | |
|---|---|---|---|
| CAT-10 | 5985-01-380-3801 | NAT-10 | 5985-01-291-5548 |
| CAT-15 | 5985-01-299-9257 | NAT-30 | 5985-01-298-0746 |
| CAT-20 | 5985-01-265-0338 | SAT-3 | 5985-01-418-0247 |
| CAT-30 | 5985-01-296-0943 | SAT-6 | 5985-01-237-5343 |
| CAT-5 | 5985-01-299-9258 | SAT-10 | 5985-01-250-4812 |
| CAT-6 | 5985-01-300-0481 | SAT-15 | 5985-01-418-0250 |
| NAT-3 | 5985-01-298-0747 | SAT-30 | 5985-01-190-6838 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

NAT



SAT

| | MODEL NO. | FREQUENCY RANGE, MHz $f_L$-$f_U$ | ATTENUATION dB Nom. | FLATNESS, MAX. L | M | U | VSWR max. L | M | U | POWER,W | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NAT-1 | DC-1500 | 1±0.2 | 0.3 | 0.4 | 0.5 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF57 | - | 23.95 |
| NEW | NAT-1-2W | DC-2000 | 1±0.2 | 0.2 | 0.3 | 0.5* | 1.3 | 1.4 | 1.5** | 2 | — | FF57 | - | 26.95 |
| | NAT-2 | DC-1500 | 2±0.2 | 0.3 | 0.4 | 0.8 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF57 | - | 23.95 |
| NEW | NAT-2-2W | DC-2000 | 2±0.2 | 0.2 | 0.4 | 0.7* | 1.3 | 1.4 | 1.5** | 2 | — | FF57 | - | 26.95 |
| | NAT-3 | DC-1500 | 3±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF57 | - | 23.95 |
| NEW | NAT-3-2W | DC-2000 | 3±0.2 | 0.3 | 0.4 | 0.7* | 1.3 | 1.4 | 1.5** | 2 | — | FF57 | - | 26.95 |
| | NAT-4 | DC-1500 | 4±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-6 | FF57 | - | 23.95 |
| | NAT-5 | DC-1500 | 5±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF57 | - | 23.95 |
| | NAT-6 | DC-1500 | 6±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF57 | - | 23.95 |
| | NAT-7 | DC-1500 | 7±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF57 | - | 23.95 |
| | NAT-8 | DC-1500 | 8±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF57 | - | 23.95 |
| | NAT-9 | DC-1500 | 9±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-7 | FF57 | - | 23.95 |
| | NAT-10 | DC-1500 | 10±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF57 | - | 23.95 |
| | NAT-12 | DC-1500 | 12±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF57 | - | 23.95 |
| | NAT-15 | DC-1500 | 15±0.4 | 0.4 | 0.7 | 1.1 | 1.3 | 1.5 | 1.7 | 1 | 6-8 | FF57 | - | 23.95 |
| | NAT-20 | DC-1500 | 20±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 1 | 6-9 | FF57 | - | 23.95 |
| NEW | NAT-25 | DC-2000 | 25±0.5 | 0.4 | 0.8 | 1.3* | 1.3 | 1.6 | 1.8** | 1 | — | FF57 | - | 23.95 |
| | NAT-30 | DC-1000 | 30±0.5 | 0.5 | 1.0 | — | 1.3 | 1.6 | — | 1 | 6-9 | FF57 | - | 23.95 |
| | NAT-40 | DC-500 | 40±0.6 | 1.0 | — | — | 1.5 | — | — | 1 | 6-9 | FF57 | - | 23.95 |
| NEW | SAT-0.5 | DC-1500 | 0.5±0.1 | 0.2 | 0.3 | 0.3 | 1.2 | 1.2 | 1.3 | 1 | — | FF56 | - | 20.95 |
| | SAT-1 | DC-1500 | 1±0.2 | 0.3 | 0.4 | 0.5 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | FF56 | - | 20.95 |
| | SAT-2 | DC-1500 | 2±0.2 | 0.3 | 0.4 | 0.8 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | FF56 | - | 20.95 |
| NEW | SAT-2.5 | DC-1500 | 2.5±0.2 | 0.2 | 0.4 | 0.7 | 1.2 | 1.2 | 1.3 | 0.25 | — | FF56 | - | 20.95 |
| | SAT-3 | DC-1500 | 3±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | FF56 | - | 20.95 |
| | SAT-4 | DC-1500 | 4±0.2 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-6 | FF56 | - | 20.95 |
| | SAT-5 | DC-1500 | 5±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | FF56 | - | 20.95 |
| | SAT-6 | DC-1500 | 6±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | FF56 | - | 20.95 |
| | SAT-7 | DC-1500 | 7±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | FF56 | - | 20.95 |
| | SAT-8 | DC-1500 | 8±0.3 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-7 | FF56 | - | 20.95 |
| | SAT-9 | DC-1500 | 9±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | FF56 | - | 20.95 |
| | SAT-10 | DC-1500 | 10±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | FF56 | - | 20.95 |
| | SAT-12 | DC-1500 | 12±0.4 | 0.3 | 0.6 | 1.0 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | FF56 | - | 20.95 |
| | SAT-15 | DC-1500 | 15±0.4 | 0.4 | 0.7 | 1.1 | 1.3 | 1.5 | 1.7 | 0.5 | 6-8 | FF56 | - | 20.95 |
| | SAT-20 | DC-1500 | 20±0.5 | 0.4 | 0.8 | 1.3 | 1.3 | 1.6 | 1.8 | 0.5 | 6-9 | FF56 | - | 20.95 |
| | SAT-30 | DC-1000 | 30±0.5 | 0.5 | 1.0 | — | 1.3 | 1.6 | — | 0.5 | 6-9 | FF56 | - | 20.95 |
| | SAT-40 | DC-500 | 40±0.6 | 1.0 | — | — | 1.5 | — | — | 0.5 | 6-9 | FF56 | - | 20.95 |

L = DC-500 MHz  M = DC-1000 MHz  U = DC-$f_U$

CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# Amplifier Selection Guide

| | | MODEL NO. | FREQ. (MHz) $f_L$ $f_U$ | GAIN (dB) MIN. | MAX[1] POWER (dBm) | N.F. (dB) TYP. | 3rd ORDER I.P. (dBm) | VSWR[2] IN | VSWR[2] OUT | DC POWER V VOLT | DC POWER I (mA) | CASE STYLE | STD. CONN. | OPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONOLITHIC | PIN | ERA-1 | DC-8000 | 9 | +13 | 7.0 | +26 | 1.6:1 | 1.5:1 | +3.80 | 50 | VV105 | | |
| | | ERA-2 | DC-6000 | 12 | +14 | 6.0 | +27 | 1.5:1 | 1.5:1 | +3.80 | 50 | VV105 | | |
| | | ERA-3 | DC-3000 | 17 | +11 | 4.5 | +23 | 1.7:1 | 1.8:1 | +3.80 | 35 | VV105 | | |
| | | ERA-4 | DC-4000 | 11 | +19.1 | 5.2 | +36 | 1.6:1 | 1.4:1 | +5.00 | 80 | VV105 | | |
| | | ERA-5 | DC-4000 | 16 | +19.6 | 4.0 | +36 | 1.2:1 | 1.3:1 | +5.00 | 80 | VV105 | | |
| | | MAR-1 | DC-1000 | 13.0 | +1.5 | 5.5 | +14 | 1.3:1 | 1.3:1 | +5.00 | 17 | VV105 | | SMT● |
| | | MAR-2 | DC-2000 | 8.5 | +4.5 | 6.5 | +17 | 1.3:1 | 1.4:1 | +5.00 | 25 | VV105 | | SMT● |
| | | MAR-3▼ | DC-2000 | 8.0 | +10. | 6.0 | +23 | 1.5:1 | 1.7:1 | +5.00 | 35 | VV105 | | SMT● |
| | | MAR-4 | DC-1000 | 7.0 | +12.5 | 6.5 | +25.5 | 1.6:1 | 2.0:1 | +5.25 | 50 | VV105 | | SMT● |
| | | MAR-6▼ | DC-2000 | 9.0 | +2 | 3.0 | +14.5 | 1.5:1 | 1.4:1 | +3.50 | 16 | VV105 | | SMT● |
| | | MAR-7▼ | DC-2000 | 8.5 | +5.5 | 5.0 | +19 | 1.4:1 | 1.5:1 | +4.00 | 22 | VV105 | | SMT● |
| | | MAR-8 | DC-1000 | 19.0 | +12.5 | 3.3 | +27 | 3.1:1 | 3.1:1 | +7.80 | 36 | VV105 | | SMT● |
| | | MAV-1 | DC-1000 | 12.5 | +1.5 | 5.5 | +14 | 1.4:1 | 1.3:1 | +5.00 | 17 | BBB123 | | |
| | | MAV-2 | DC-1500 | 7.5 | +4.5 | 6.5 | +17 | 1.3:1 | 1.4:1 | +5.00 | 25 | BBB123 | | SMT● |
| | | MAV-3 | DC-1500 | 7.5 | +10 | 6.0 | +23 | 1.3:1 | 1.6:1 | +5.00 | 35 | BBB123 | | SMT● |
| | | MAV-4 | DC-1000 | 7.0 | +11.5 | 7.0 | +24.5 | 1.4:1 | 1.8:1 | +5.25 | 50 | BBB123 | | SMT● |
| | | MAV-11 | 50-1000 | 9.0 | +17.5 | 3.6 | +30 | 1.5:1 | 1.7:1 | +5.50 | 60 | BBB123 | | SMT● |
| | SMT● | ERA-1SM | DC-8000 | 8.4 | +13 | 7.0 | +26 | 1.8:1 | 1.7:1 | +3.80 | 50 | WW107 | | |
| | | ERA-2SM | DC-6000 | 10.2 | +13 | 6.0 | +27 | 1.8:1 | 1.7:1 | +3.80 | 50 | WW107 | | |
| | | ERA-3SM | DC-3000 | 16.2 | +11 | 4.5 | +23 | 1.8:1 | 1.9:1 | +3.80 | 50 | WW107 | | |
| | | ERA-4SM | DC-4000 | 11 | +19.1 | 5.2 | +36 | 1.6:1 | 1.3:1 | +5.00 | 80 | WW107 | | |
| | | ERA-5SM | DC-4000 | 16 | +19.4 | 4.0 | +36 | 1.3:1 | 1.2:1 | +5.00 | 80 | WW107 | | |
| | | MAV-5SM | 50-1500 | 5.5 | +18 | 6.5 | +29 | 1.6:1 | 2.0:1 | +8.40 | 80 | RRR137 | | |
| | | RAM-1 | DC-1000 | 13.0 | +1.5 | 5.5 | +14 | 1.3:1 | 1.3:1 | +5.00 | 17 | AF190 | | |
| | | RAM-2 | DC-2000 | 8.5 | +4.5 | 6.5 | +17 | 1.2:1 | 1.4:1 | +5.00 | 25 | AF190 | | |
| | | RAM-3 | DC-2000 | 8.0 | +10 | 6.0 | +23 | 1.6:1 | 1.7:1 | +5.00 | 35 | AF190 | | |
| | | RAM-4 | DC-1000 | 7.0 | +12.5 | 6.5 | +25.5 | 1.4:1 | 1.9:1 | +5.25 | 50 | AF190 | | |
| | | RAM-6 | DC-2000 | 9.0 | +2 | 2.8 | +14.5 | 1.4:1 | 1.3:1 | +3.50 | 16 | AF190 | | |
| | | RAM-7 | DC-2000 | 8.5 | +5.5 | 4.5 | +19 | 2.0:1 | 1.8:1 | +4.00 | 22 | AF190 | | |
| | | RAM-8 | DC-1000 | 19.0 | +12.5 | 3.0 | +27 | 3.1:1 | 3.1:1 | +7.80 | 36 | AF190 | | |
| | | VNA-25 | 500-2500 | 11.5 | +15.5 | 5.5 | +27 | 1.5:1* | 1.6:1 | +5.00 | 85 | XX112 | | |
| VAR. GAIN | CON | ZFL-1000G | 10-1000 | 17.0 | +3 | 12.0 | +13 | 2.0:1 | 2.0:1 | +15.00 | 100 | Y39 | SMA | — |
| | | ZFL-1000GH | 10-1200 | 24.0 | +13 | 15.0 | +25 | 2.2:1 | 2.0:1 | +15.00 | 170 | Y39 | SMA | — |
| LOW NOISE (N.F.<4.0 dB) | PIN | MAN-1LN | 0.5-500 | 28.0 | +8 | 2.8 | +18 | 1.8:1 | 1.8:1 | +12.00 | 60 | A05 | | |
| | | AMP-76 | 5-500 | 26.0 | +13.5 | 3.1 | +28 | 2.0:1 | 2.0:1 | +15.00 | 68 | PP120 | | |
| | | AMP-77 | 5-500 | 15.0 | +16 | 3.3 | +32 | 2.0:1 | 2.0:1 | +15.00 | 56 | PP120 | | |
| | | AMP-75 | 5-500 | 19.0 | +12 | 2.4 | +28 | 2.0:1 | 2.0:1 | +15.00 | 29 | PP120 | | |
| | | AMP-15 | 5-1000 | 13.0 | +8 | 2.8 | +22 | 2.0:1 | 2.0:1 | +15.00 | 29 | PP120 | | |
| | | AMP-11-2 | 5-1000 | 14.0 | +3.5 | 3.0 | +13 | 2.0:1 | 2.0:1 | +15.00 | 12 | PP120 | | |
| | | MAN-1HLN | 10-500 | 10.0 | +15 | 3.7 | +30 | 1.8:1 | 1.8:1 | +12.00 | 70 | A06 | | |
| | | TO-0812LN | 800-1200 | 20.0 | +8 | 1.6 | +18 | 2.5:1 | 2.5:1 | +15.00 | 70 | QQ96 | | |
| | | TO-1217LN | 1200-1700 | 20.0 | +10 | 1.6 | +25 | 2.5:1 | 2.5:1 | +15.00 | 70 | QQ96 | | |
| | | TO-1724LN | 1700-2400 | 20.0 | +10 | 1.6 | +22 | 2.5:1 | 2.5:1 | +15.00 | 70 | QQ96 | | |
| | CON | ZFL-500LN | 0.1-500 | 24.0 | +5 | 2.9 | +14 | 1.5:1 | 1.6:1 | +15.00 | 60 | Y39 | SMA | BNC |
| | | ZFL-1000LN | 0.1-1000 | 20.0 | +3 | 2.9 | +14 | 1.5:1 | 2.0:1 | +15.00 | 60 | Y39 | SMA | — |
| | | ZFL-500HLN | 10-500 | 19.0 | +16 | 3.8 | +30 | 1.5:1 | 1.5:1 | +15.00 | 110 | Y39 | SMA | — |
| | | ZEL-0812LN | 800-1200 | 20.0 | +8 | 1.5 | +18 | 2.5:1 | 2.5:1 | +15.00 | 70 | EEE132 | SMA | — |
| | | ZHL-0812HLN | 800-1200 | 30.0 | +26 | 1.5 | +36 | 2.4:1 | 2.4:1 | +15.00 | 725 | NN92 | SMA | |
| | | ZEL-1217LN | 1200-1700 | 20.0 | +10 | 1.5 | +25 | 2.5:1 | 2.5:1 | +15.00 | 70 | EEE132 | SMA | — |
| | | ZHL-1217HLN | 1200-1700 | 30.0 | +26 | 1.5 | +36 | 2.4:1 | 2.4:1 | +15.00 | 725 | NN92 | SMA | |
| | | ZEL-1724LN | 1700-2400 | 20.0 | +10 | 1.5 | +22 | 2.5:1 | 2.5:1 | +15.00 | 70 | EEE132 | SMA | — |
| | | ZHL-1724HLN | 1700-2400 | 30.0 | +26 | 1.5 | +36 | 2.4:1 | 2.4:1 | +15.00 | 725 | NN92 | SMA | |
| HIGH ISOLATION | PIN | MAN-2AD | 2-1000 | 9.0 | -2 | 6.5 | +14 | 2.0:1 | 2.0:1 | +15.00 | 22 | A05 | | |
| | | MAN-11AD | 2-2000 | 8.0 | -3.5 | 6.5 | +14 | 3.0:1 | 2.0:1 | +15.00 | 22 | A05 | | |
| | | MAN-1AD | 5-500 | 16.0 | +7 | 7.2 | +20 | 1.6:1 | 1.7:1 | +12.00 | 85 | A05 | | |
| | CON | ZFL-2AD | 2-1000 | 10.0 | -2 | 6.5 | +14 | 2.0:1 | 2.0:1 | +15.00 | 22 | Y39 | SMA | — |
| | | ZFL-11AD | 2-2000 | 8.0 | -3.5 | 6.5 | +14 | 2.5:1 | 2.0:1 | +15.00 | 22 | Y39 | SMA | — |
| | | ZFL-1HAD | 10-500 | 10.0 | +20 | 7.5 | +30 | 1.3:1 | 1.35:1 | +15.00 | 115 | SS98 | SMA | — |
| | | ZFL-2HAD | 50-1000 | 11.0 | +20 | 5.0 | +33 | 2.0:1 | 2.0:1 | +15.00 | 110 | SS98 | SMA | |
| | | ZHL-1HLD | 225-400 | 23.0 | +27 | 2.5 | +40 | 2.0:1 | 2.0:1 | +24.00 | 525 | T34 | SMA | — |

[1] Minimum output power at 1 dB gain compression
[2] For ERA models, VSWR given as DC-3GHz
● SMT Surface Mount
▼ Alternate package style SOT 143, see VAM series.
* Increase below 1500 MHz

Using the Selection Guide

Locate the Mini-Circuits' amplifier best suited for your particular application quickly with this convenient Selection Guide. Amplifiers are grouped into eight major categories and then listed in the sequence of frequency span.

If your amplifier requirements are not met by the catalog models listed, we encourage you to contact our Application Engineering Department. You will find them courteous and eager to support your needs with their depth of knowledge coupled with our extensive database on engineering and catalog models.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

| | | MODEL NO. | FREQ. (MHz) $f_L$ | $f_U$ | GAIN (dB) MIN. | MAX[1] POWER (dBm) | N.F. (dB) TYP. | 3rd ORDER I.P. (dBm) | VSWR IN | VSWR OUT | DC POWER V VOLT | DC POWER I (mA) | CASE STYLE | STD. CONN. | OPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW POWER | PIN | MAN-1 | 0.5-500 | | 28.0 | +8 | 4.5 | +18 | 1.8:1 | 1.8:1 | +12.00 | 60 | A05 | | |
| | | MAN-2 | 0.5-1000 | | 18.0 | +9 | 6.0 | +19 | 1.8:1 | 1.8:1 | +12.00 | 85 | A05 | | |
| | | AMP-74 | 5-500 | | 27.0 | +7 | 5.0 | +20 | 2.0:1 | 2.0:1 | +15.00 | 44 | PP120 | | |
| | | AMP-3G | 30-3000 | | 8.0 | +9.5 | 3.5 | +20 | 2.6:1 | 2.5:1 | +15.00 | 55 | PP120 | | |
| | CON | ZFL-500 | 0.05-500 | | 20.0 | +9 | 5.3 | +18 | 1.9:1 | 1.9:1 | +15.00 | 60 | Y39 | SMA | BNC |
| | | ZFL-1000 | 0.1-1000 | | 17.0 | +9 | 6.0 | +18 | 1.5:1 | 2.0:1 | +15.00 | 105 | Y39 | SMA | — |
| | | ZFL-750 | 0.2-750 | | 18.0 | +9 | 6.0 | +18 | 1.5:1 | 2.0:1 | +15.00 | 90 | Y39 | SMA | — |
| | | ZJL-7G | 20-7000 | | 6.5 | +9 | 7.0 | +27 | 1.5:1 | 1.5:1 | +12.00 | 60 | BW459 | SMA | — |
| | | ZJL-6G | 20-6000 | | 9.5 | +10 | 6.0 | +27 | 1.3:1 | 1.5:1 | +12.00 | 60 | BW459 | SMA | — |
| | | ZJL-3G | 20-3000 | | 15.0 | +8 | 4.5 | +18 | 1.4:1 | 1.6:1 | +12.00 | 45 | BW459 | SMA | — |
| MEDIUM POWER | PIN | AMP-2000 | 10-2000 | | 20.0 | +15 | 5.0 | +25 | 2.0:1 | 2.0:1 | +15.00 | 100 | QQ96 | | |
| | CON | ZHL-6A | .0025-500 | | 21.0 | +23 | 7.5 | +34 | 1.8:1 | 2.0:1 | +24.00 | 350 | S32 | BNC | — |
| | | ZFL-1000H | 10-1000 | | 28.0 | +20 | 5.0 | +33 | 2.0:1 | 2.0:1 | +15.00 | 150 | SS98 | SMA | — |
| | | ZFL-1000VH | 10-1000 | | 20.0 | +25 | 4.5 | +38 | 1.8:1 | 2.0:1 | +15.00 | 320 | SS98 | SMA | — |
| | | ZFL-2000 | 10-2000 | | 20.0 | +16 | 7.0 | +25 | 2.0:1 | 2.0:1 | +15.00 | 100 | Y39 | SMA | — |
| | | ZFL-2500 | 500-2500 | | 28.0 | +15 | 8.0 | +27 | 2.5:1 | 2.5:1 | +5.00 | 220 | Y39 | SMA | — |
| | | ZFL-2500VH | 10-2500 | | 20.0 | +24 | 5.5 | +35 | 1.7:1 | 2.0:1 | +15.00 | 300 | SS98 | SMA | — |
| | | ZHL-1042J | 10-4200 | | 25.0 | +20 | 4.5 | +30 | 2.5:1 | 2.5:1 | +15.00 | 300 | NN92 | SMA | — |
| | | ZJL-4G | 20-4000 | | 10.0 | +11 | 5.0 | +31 | 1.3:1 | 1.5:1 | +12.00 | 90 | BW459 | SMA | — |
| | | ZJL-4HG | 20-4000 | | 12.0 | +11 | 4.5 | +31 | 1.8:1 | 1.4:1 | +12.00 | 90 | BW459 | SMA | — |
| | | ZRON-8G | 2000-8000 | | 20.0 | +20 | 6.0 | +30 | 2.0:1 | 2.0:1 | +15.00 | 310 | AV243 | SMA | — |
| MEDIUM HIGH POWER | CON | ZHL-32A | .05-130 | | 25.0 | +29 | 10.0 | +38 | 2.0:1 | 2.0:1 | +24.00 | 600 | S32 | BNC | SMA,N |
| | | ZHL-3A | .4-150 | | 24.0 | +29.5 | 11.0 | +38 | 2.0:1 | 2.0:1 | +24.00 | 600 | S32 | BNC | SMA,N |
| | | ZHL-1A | 2-500 | | 16.0 | +28 | 11.0 | +38 | 2.0:1 | 2.0:1 | +24.00 | 600 | S32 | BNC | SMA,N |
| | | ZHL-2 | 10-1000 | | 16.0 | +29 | 9.0 | +38 | 2.0:1 | 2.0:1 | +24.00 | 600 | T34 | BNC | SMA,N |
| | | ZHL-2-8 | 10-1000 | | 27.0 | +29 | 10.0 | +38 | 2.0.1 | 2.0:1 | +24.00 | 600 | T34 | BNC | SMA,N |
| | | ZHL-2-12 | 10-1200 | | 24.0 | +29 | 10.0 | +38 | 2.0:1 | 2.0:1 | +24.00 | 750 | T34 | SMA | — |
| | | ZHL-42W | 10-4200 | | 30.0 | +28 | 8.0 | +38 | 2.5:1 | 2.5:1 | +15.00 | 880 | U36 | SMA | — |
| | | ZHL-4240W | 10-4200 | | 40.0 | +28 | 8.0 | +38 | 2.5:1 | 2.5:1 | +15.00 | 900 | U36 | SMA | — |
| | | ZHL-42 | 700-4200 | | 30.0 | +28 | 10.0 | +38 | 2.5:1 | 2.5:1 | +15.00 | 880 | U36 | SMA | — |
| | | ZHL-4240 | 700-4200 | | 40.0 | +28 | 8.0 | +38 | 2.5:1 | 2.5:1 | +15.00 | 900 | U36 | SMA | — |
| | | ZVE-8G | 2000-8000 | | 30.0 | +30 | 4.0 | +40 | 2.0:1 | 2.0:1 | +12.00 | 2000 | BN333 | SMA | — |
| HIGH POWER | CON | ZHL-5W-1 | 1-500 | | 40.0 | +37 | 8.0 | +49 | 2.0:1 | 2.5:1 | +24.00 | 3300 | DDD131 | SMA | — |
| | | ZHL-1-2W | 5-500 | | 29.0 | +33 | 12.0 | +44 | 2.0:1 | 2.0:1 | +24.00 | 900 | T35 | BNC | SMA,N |
| | | ZHL-900-10W | 480-900 | | 19.0 | +38 | 10.0 | +50 | 2.0:1 | 2.0:1 | +24.00 | 5500 | DDD131 | SMA | — |
| | | ZHL-1000-3W | 500-1000 | | 38.0 | +35 | 9.0 | +45 | 2.0:1 | 2.5:1 | +24.00 | 2000 | DDD131 | SMA | — |
| | | ZHL-7-2W | 600-800 | | 28.0 | +33 | 12.0 | +43 | 2.0:1 | 2.0:1 | +24.00 | 900 | T35 | BNC | SMA,N |
| VERY HIGH POWER | CON | LZY-1 | 20-512 | | 39.0 | +44 | 8.6 | +54 | 2.0:1 | 9.0:1 | +26.00 | 7300 | BT412 | SMA | — |
| | | LZY-2 | 500-1000 | | 40.0 | +43 | 8.0 | +54 | 2.0:1 | 3.5:1 | +28.00 | 8000 | BT451 | SMA | — |
| LOW DISTORTION FEED FORWARD | CON | ZHL-1-50P3 | 50-500 | | 22.0 | +30 | 7.0 | +50 | 1.5:1 | 1.5:1 | +24.00 | 1300 | U200 | SMA | — |
| | | ZHL-2-50P3 | 50-1000 | | 21.0 | +25 | 8.0 | +43 | 2.0:1 | 2.0:1 | +24.00 | 650 | U200 | SMA | — |

# Environmental Specifications

| MODEL | OPERATING TEMP. | AMBIENT | | STORAGE TEMP. | STABILIZATION BAKE (NON-OPER.) 125°C 24 hr. | TEMPERATURE CYCLING (NON-OPER.) -55°C TO +100°C | CONSTANT ACCELERATION (Y1 PLANE) ONLY | BURN-IN (DC. ON) 85°C * 160 hr. | SEAL TEST FINE | SEAL TEST GROSS |
|---|---|---|---|---|---|---|---|---|---|---|
| AMP | -54°C—85°C | | ✔ | -55°C—100°C | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| LZY | -10°C—50°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| MAN | -54°C—85°C | | ✔ | -55°C—100°C | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| MAR/ERA | -20°C—85°C | | ✔ | -55°C—100°C | ✔ | ✔ | ✔ | ✔ | N.A. | N.A. |
| MAV/VAM | -20°C—85°C | | ✔ | -55°C—100°C | ✔ | ✔ | ✔ | ✔ | N.A. | N.A. |
| RAM | -54°C—125°C | | ✔ | -65°C—150°C | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| TO | -54°C—85°C | | ✔ | -55°C—100°C | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| VNA | -40°C—70°C | | ✔ | -55°C—150°C | ✔ | ✔ | ✔ | ✔ | N.A. | N.A. |
| ZEL | -54°C—85°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZFL | -20°C—71°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZFL-2000 | -55°C—100°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZFL-2500 | -20°C—65°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZHL | -20°C—65°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZHL-HLN | -54°C—65°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZJL | -40°C—75°C | ✔ | | -55°C—100°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |
| ZRON | 0°C—60°C | | ✔ | -55°C—125°C | ✔ | ✔ | ✔ | ✔ | N.A. | ✔ |
| ZVE-8G | -55°C—90°C | | ✔ | -65°C—150°C | ✔ | ✔ | N.A. | ✔ | N.A. | N.A. |

NOTES: Units are designed and manufactured to meet the environmental specifications as indicated.

*Or max. operating temp., whichever is less.

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# MONOLITHIC AMPLIFIERS 50Ω Drop-In & Surface Mount

## BROADBAND DC to 8 GHz

ERA

ERA-SM

**All specifications at 25°C**

| MODEL NO. | ✪ FREQ. GHz $f_l$ - $f_u$ | GAIN, dB Typical over frequency, GHz 0.1 | 1 | 2 | 3 | 4 | 6 | 8 | Min.@ 2 GHz | Flatness DC-2 GHz | MAXIMUM POWER, dBm at 2 GHz* Output (1 dB Comp.) Typ. | Min. | Input (no dmg.) | DYNAMIC RANGE at 2 GHz* NF dB Typ. | IP3 dBm Typ. | VSWR Typ. (:1) In DC-3 GHz | In 3-$f_u$** GHz | Out DC-3 GHz | Out 3-$f_u$** GHz | MAXIMUM RATING I (mA) | P (mW) | DC POWER at Pin 3 Current (mA) | Volt Typ. | THERMAL RESISTANCE θjc, typ. °C/W | Case Style Note B | CONNECTION | Price $ Qty. (30) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERA-1 | DC-8 | 11.8 | 11.7 | 11.6 | 11.2 | 10.9 | 10.5 | 9.6 | 9 | ±0.15 | 13 | 11 | 15 | 7 | 26 | 1.6 | 2.2 | 1.5 | 2.1 | 75 | 330 | 50 | 3.8 | 531 | VV105 | cb | 1.37 |
| ERA-2 | DC-6 | 16.0 | 15.6 | 14.9 | 13.9 | 13.1 | 11.8 | — | 12 | ±0.6 | 14 | 12 | 15 | 6 | 27 | 1.5 | 1.5 | 1.5 | 2.0 | 75 | 330 | 50 | 3.8 | 531 | VV105 | cb | 1.52 |
| ERA-3 | DC-3 | 22.2 | 21.4 | 20.2 | 18.2 | -- | — | — | 17 | ±1.1 | 11 | 8 | 13 | 4.5 | 23 | 1.7 | -- | 1.8 | -- | 75 | 330 | 35 | 3.8 | 432 | VV105 | cb | 1.67 |
| ERA-4 | DC-4 | 13.8 | 14.0 | 13.9 | 13.9 | 13.4 | — | — | 11 | ±0.10 | 19.1 | 17 | 13 | 5.2 | 36 | 1.6 | 1.5 | 1.4 | 1.6 | 120 | 650 | 80 | 5.0 | 290 | VV105 | cb | 3.85 |
| ERA-5 | DC-4 | 20.4 | 20.0 | 19.0 | 17.7 | 15.8 | — | — | 16 | ±0.75 | 19.6 | 17.5 | 13 | 4.0 | 36 | 1.2 | 1.2 | 1.3 | 1.6 | 120 | 650 | 80 | 5.0 | 290 | VV105 | cb | 3.85 |
| ERA-1SM | DC-8 | 11.8 | 11.6 | 11.0 | 10.5 | 9.8 | 8.8 | 8.2 | 8 | ±0.5 | 13 | 11 | 15 | 7 | 26 | 1.8 | 2.2 | 1.7 | 2.2 | 75 | 330 | 50 | 3.8 | 536 | WW107 | cb | 1.42 |
| ERA-2SM | DC-6 | 15.6 | 15.3 | 13.1 | 11.8 | 11.1 | 10.0 | — | 10 | ±0.9 | 13 | 12 | 15 | 6 | 27 | 1.8 | 1.7 | 1.7 | 1.9 | 75 | 330 | 50 | 3.8 | 536 | WW107 | cb | 1.57 |
| ERA-3SM | DC-3 | 22.1 | 21.2 | 19.4 | 17.3 | -- | -- | — | 16 | ±1.5 | 11 | 8 | 13 | 4.5 | 23 | 1.8 | -- | 1.9 | -- | 75 | 330 | 35 | 3.8 | 437 | WW107 | cb | 1.72 |
| ERA-4SM | DC-4 | 13.8 | 14.0 | 13.9 | 13.8 | 13.3 | -- | — | 11 | ±0.10 | 19.1 | 17 | 13 | 5.2 | 36 | 1.6 | 1.5 | 1.3 | 1.3 | 120 | 650 | 80 | 5.0 | 290 | WW107 | cb | 3.90 |
| ERA-5SM | DC-4 | 20.4 | 20.0 | 19.0 | 17.6 | 15.8 | — | — | 16 | ±0.75 | 19.4 | 17.5 | 13 | 4.0 | 36 | 1.3 | 1.4 | 1.2 | 1.2 | 120 | 650 | 80 | 5.0 | 295 | WW107 | cb | 3.90 |

### features

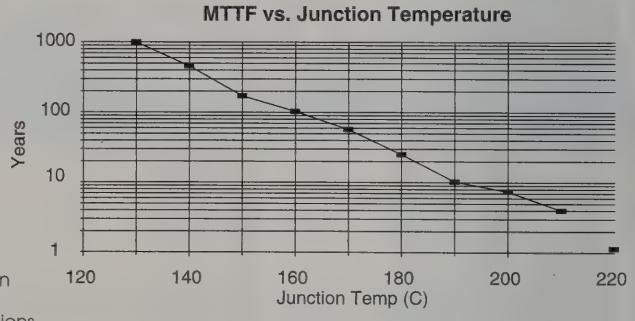
- miniature microwave amplifier
- available in drop-in & surface mount (sm) versions
- frequency range, DC to 8 GHz, usable to 10 GHz
- up to 19.6 dBm typ. (17.5 dBm min) output power

### marking identification

| Model | Alphanumeric Code |
|---|---|
| ERA-1, ERA-1SM | E1 |
| ERA-2, ERA-2SM | E2 |
| ERA-3, ERA-3SM | E3 |
| ERA-4, ERA-4SM | E4 |
| ERA-5, ERA-5SM | E5 |

### absolute maximum ratings

operating temperature: -25° to 85°C
storage temperature: -65° to 150°C
device voltage: 3.2V min., 4.4V max. for ERA 1,2,3
4.2V min., 6.0V max. for ERA 4,5
maximum case temperature: 200°C
(for continuous operation)

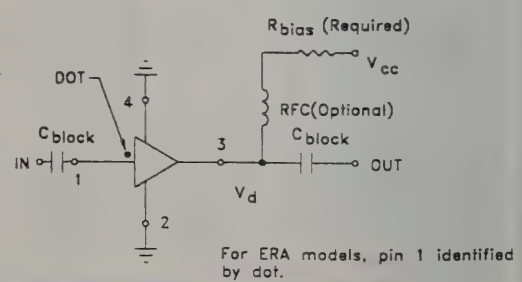



NOTES:
* at 1 GHz for ERA 4, 5, 4SM, 5SM.
** $f_u$ is the upper frequency limit for each model as shown in the table.
✪ Low frequency cutoff determined by external coupling capacitors.
A. Environmental specifications and re-flow soldering information available in General Information Section.
B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Model number designated by alphanumeric code marking.
2. ERA-SM models available on tape and reel.

### designers kits available

| KIT NO. | Model Type | No. of Units in Kit | Description | Price $ per kit |
|---|---|---|---|---|
| K1-ERA | ERA | 30 | 10 of each 1,2,3 | 49.95 |
| K2-ERA | ERA | 20 | 10 of each 4,5 | 69.95 |
| K1-ERASM | ERA-SM | 30 | 10 of each 1SM, 2SM,3SM | 49.95 |
| K2-ERASM | ERA-SM | 20 | 10 of each 4SM, 5SM | 69.95 |

### Typical Biasing Configuration ERA



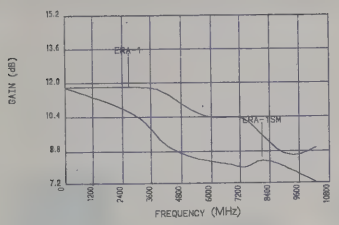
For ERA models, pin 1 identified by dot.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## ERA-1/ERA-1SM

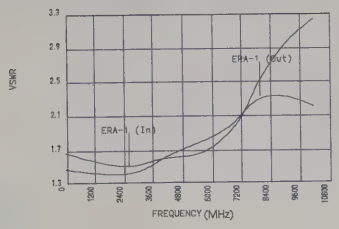
GAIN




GAIN (dB)

| FREQUENCY (MHz) | ERA-1 | ERA-1SM |
|---|---|---|
| 100.00 | 11.82 | 11.80 |
| 2363.20 | 11.84 | 10.90 |
| 3494.80 | 11.80 | 10.15 |
| 4060.60 | 11.72 | 8.96 |
| 5758.00 | 10.20 | 8.27 |
| 6889.60 | 10.45 | 8.19 |
| 7455.40 | 10.33 | 7.84 |
| 8021.20 | 9.62 | 8.52 |
| 9152.80 | 8.28 | 7.96 |
| 10284.40 | 8.92 | 7.29 |

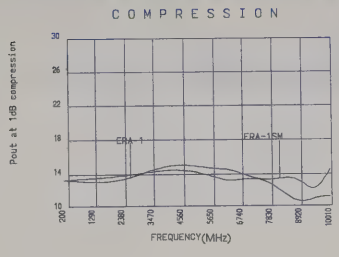
VSWR




VSWR

| IN ERA-1 | OUT ERA-1 | IN ERA-1SM | OUT ERA-1SM |
|---|---|---|---|
| 1.67 | 1.48 | 1.71 | 1.54 |
| 1.48 | 1.39 | 2.06 | 1.80 |
| 1.55 | 1.48 | 1.97 | 1.80 |
| 1.62 | 1.62 | 2.19 | 2.12 |
| 1.62 | 1.80 | 2.35 | 2.31 |
| 1.91 | 1.96 | 2.09 | 2.10 |
| 2.12 | 2.16 | 1.98 | 1.97 |
| 2.52 | 2.32 | 2.27 | 2.03 |
| 2.98 | 2.35 | 2.44 | 2.44 |
| 3.23 | 2.21 | 2.19 | 1.77 |

COMPRESSION

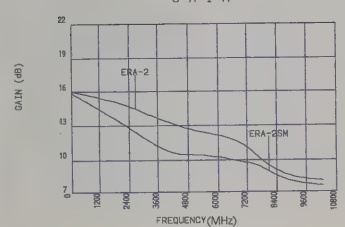



Pout (dBm) (@1dB COMPR)

| FREQUENCY (MHz) | ERA-1 | ERA-1SM |
|---|---|---|
| 200.00 | 13.30 | 13.31 |
| 2037.80 | 12.78 | 13.62 |
| 3263.00 | 14.31 | 14.14 |
| 4488.20 | 15.32 | 14.66 |
| 5713.40 | 14.44 | 13.68 |
| 6326.00 | 14.67 | 12.88 |
| 7551.20 | 12.77 | 13.95 |
| 8776.40 | 14.08 | 10.17 |
| 9389.00 | 11.23 | 11.15 |
| 10001.60 | 14.43 | 11.30 |

## ERA-2/ERA-2SM

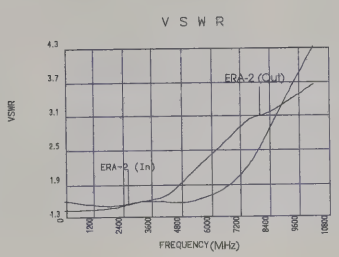
GAIN




GAIN (dB)

| FREQUENCY (MHz) | ERA-2 | ERA-2SM |
|---|---|---|
| 100.00 | 15.82 | 15.68 |
| 2207.50 | 14.82 | 13.02 |
| 3050.50 | 13.88 | 11.64 |
| 4315.00 | 12.89 | 10.09 |
| 5158.00 | 12.22 | 10.32 |
| 6857.40 | 11.71 | 9.71 |
| 7714.80 | 9.88 | 9.26 |
| 8143.50 | 9.17 | 8.65 |
| 9000.90 | 8.15 | 7.75 |
| 10287.00 | 7.92 | 7.47 |

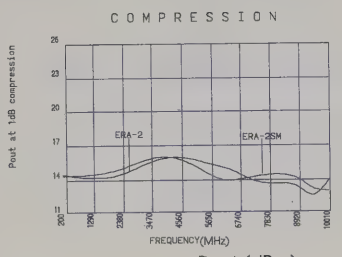
VSWR




VSWR

| IN ERA-2 | OUT ERA-2 | IN ERA-2SM | OUT ERA-2SM |
|---|---|---|---|
| 1.56 | 1.40 | 1.62 | 1.45 |
| 1.43 | 1.41 | 2.00 | 1.91 |
| 1.57 | 1.57 | 1.97 | 2.00 |
| 1.55 | 1.58 | 1.90 | 2.03 |
| 1.50 | 2.03 | 1.45 | 1.41 |
| 1.77 | 2.65 | 1.81 | 1.70 |
| 2.22 | 3.06 | 2.09 | 1.73 |
| 2.52 | 3.03 | 2.77 | 1.77 |
| 3.26 | 3.23 | 3.13 | 1.74 |
| 4.26 | 3.60 | 5.59 | 2.36 |

COMPRESSION

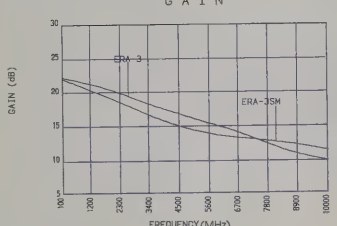



Pout (dBm) (@1dB COMPR)

| FREQUENCY (MHz) | ERA-2 | ERA-2SM |
|---|---|---|
| 200.00 | 14.21 | 14.13 |
| 2037.80 | 13.66 | 14.26 |
| 3263.00 | 15.31 | 15.72 |
| 4488.20 | 16.06 | 15.95 |
| 5713.40 | 14.98 | 13.98 |
| 6326.00 | 14.88 | 13.52 |
| 7551.20 | 13.05 | 14.22 |
| 8776.40 | 13.78 | 14.30 |
| 9389.00 | 11.71 | 12.79 |
| 10001.60 | 13.65 | 12.75 |

## ERA-3/ERA-3SM

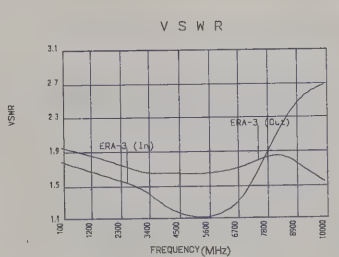
GAIN




GAIN (dB)

| FREQUENCY (MHz) | ERA-3 | ERA-3SM |
|---|---|---|
| 100.00 | 22.32 | 22.14 |
| 2000.00 | 20.55 | 19.11 |
| 3263.60 | 18.38 | 16.92 |
| 4106.00 | 17.38 | 15.49 |
| 5369.60 | 15.69 | 14.10 |
| 6212.00 | 14.83 | 13.54 |
| 7054.40 | 13.59 | 13.24 |
| 8318.00 | 11.60 | 12.69 |
| 9160.40 | 10.64 | 12.16 |
| 10002.80 | 10.01 | 11.52 |

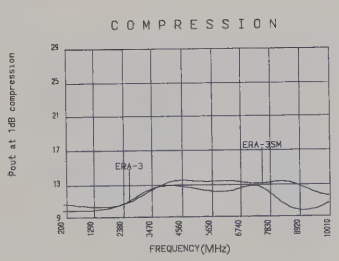
VSWR




VSWR

| IN ERA-3 | OUT ERA-3 | IN ERA-3SM | OUT ERA-3SM |
|---|---|---|---|
| 1.79 | 1.96 | 1.98 | 1.95 |
| 1.60 | 1.80 | 1.74 | 1.78 |
| 1.48 | 1.64 | 1.64 | 1.89 |
| 1.21 | 1.66 | 1.44 | 2.11 |
| 1.11 | 1.64 | 1.46 | 1.98 |
| 1.18 | 1.67 | 1.49 | 1.89 |
| 1.36 | 1.73 | 1.27 | 1.61 |
| 2.20 | 1.92 | 1.66 | 1.60 |
| 2.57 | 1.72 | 2.10 | 1.70 |
| 2.68 | 1.55 | 4.61 | 1.41 |

COMPRESSION




Pout (dBm) (@1dB COMPR)

| FREQUENCY (MHz) | ERA-3 | ERA-3SM |
|---|---|---|
| 200.00 | 10.86 | 10.04 |
| 2262.80 | 10.08 | 10.03 |
| 3294.20 | 12.21 | 12.76 |
| 4325.60 | 13.88 | 13.12 |
| 5357.00 | 13.24 | 12.39 |
| 6388.40 | 13.66 | 11.92 |
| 7419.80 | 12.87 | 13.74 |
| 8451.20 | 13.80 | 9.88 |
| 9482.60 | 11.96 | 9.97 |
| 10000.00 | 11.71 | 10.87 |

CAPD now available! computer-automated performance data

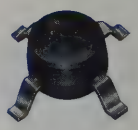
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# MONOLITHIC AMPLIFIERS 50 Ω

## BROADBAND DC to 2.5 GHz

MAR-SM


MAV-SM

### up to +18 dBm output

| MODEL NO. | ✪FREQ. MHz | GAIN, dB Typical (at MHz) 100 | 1000 | 2000 | note 1 MIN. | MAXIMUM POWER, dBm note 5 Typ. Output (1 dB Comp.) | Input (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR Typ. In | Out | MAXIMUM RATING (25 °C) I (mA) | P (mW) | DC POWER at Pin 3 Current (mA) | Volt Typ. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ (Qty 30) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAR-1SM | DC-1000 | 18.5 | 15.5 | — | 13.0 | +1.5 | +13 | 5.5 | +14.0 | 1.3:1 | 1.2:1 | 40 | 200 | 17 | 5.00 | 3-22 | WW107 | cb | 1.04 |
| MAR-2SM | DC-2000 | 12.5 | 12.0 | 11.0 | 8.5 | +4.5 | +13 | 6.5 | +17.0 | 1.5:1 | 1.4:1 | 60 | 325 | 25 | 5.00 | 3-22 | WW107 | cb | 1.17 |
| MAR-3SM | DC-2000 | 12.5 | 12.0 | 10.5 | 8.0 | +10.0 | +13 | 6.0 | +23.0 | 1.5:1 | 1.7:1 | 70 | 400 | 35 | 5.00 | 3-22 | WW107 | cb | 1.24 |
| MAR-4SM | DC-1000 | 8.3 | 8.0 | — | 7.0 | +12.5 | +13 | 7.0 | +25.5 | 1.5:1 | 1.9:1 | 85 | 500 | 50 | 5.25 | 3-23 | WW107 | cb | 1.34 |
| MAR-6SM | DC-2000 | 20.0 | 16.0 | 11.0 | 9.0 | +2.0 | +13 | 3.0 | +14.5 | 1.7:1 | 1.7:1 | 50 | 200 | 16 | 3.50 | 3-23 | WW107 | cb | 1.21 |
| MAR-7SM | DC-2000 | 13.5 | 12.5 | 11.0 | 8.5 | +5.5 | +13 | 5.0 | +19.0 | 1.7:1 | 1.7:1 | 60 | 275 | 22 | 4.00 | 3-23 | WW107 | cb | 1.36 |
| MAR-8SM | DC-1000 | 32.5 | 22.5 | — | 19.0 | +12.5 | +13 | 3.3 | +27.0 | # | # | 65 | 500 | 36 | 7.80 | 3-24 | WW107 | cb | 1.32 |
| MAV-1SM | DC-1000 | 18.5 | 15.0 | — | 12.5 | +1.5 | +13 | 5.5 | +14.0 | 1.4:1 | 1.3:1 | 40 | 200 | 17 | 5.00 | 3-24 | RRR137 | cb | 1.04 |
| MAV-2SM | DC-1500 | 12.5 | 11.0 | 10.0** | 7.5 | +4.5 | +13 | 6.5 | +17.0 | 1.3:1 | 1.4:1 | 60 | 325 | 25 | 5.00 | 3-24 | RRR137 | cb | 1.17 |
| MAV-3SM | DC-1500 | 12.5 | 11.0 | 10.0** | 7.5 | +10.0 | +13 | 6.0 | +23.0 | 1.3:1 | 1.6:1 | 70 | 400 | 35 | 5.00 | 3-25 | RRR137 | cb | 1.24 |
| MAV-4SM | DC-1000 | 8.3 | 7.5 | — | 7.0 | +11.5 | +13 | 7.0 | +24.5 | 1.4:1 | 1.8:1 | 85 | 500 | 50 | 5.25 | 3-25 | RRR137 | cb | 1.34 |
| MAV-5SM | 50-1500 | 8.0 | 7.0 | 6.5** | 5.5 | +18.0 | +20 | 6.5 | +29.0 | 1.6:1 | 2.0:1 | 135 | 1500 | 80 | 8.4 | — | RRR137 | cb | 1.90 |
| MAV-11SM | 50-1000 | 12.7 | 10.5 | — | 9.0 | +17.5 | +13 | 3.6 | +30.0 | 1.5:1 | 1.7:1 | 80 | 550 | 60 | 5.50 | 3-25 | RRR137 | cb | 1.62 |

NOTES:
- ☆ Increases below 1500 MHz.
- * RAM models are hermetically sealed.
- ▮ Max. Voltage 7V (DC power at pin 1).
- ** Typical gain at 1500 MHz
- ❖ Price of RAM models is for 1-9 quantity.
- # Dash-8 models input and output impedances are not 50 ohms, see S-parameter data. Conditionally stable, source and load VSWR<3:1 required. Dash-6 models conditionally stable, source and load VSWR<5:1 required.
- ✪ Low frequency cutoff determined by external coupling capacitors.
- ✻ Specification at 500 MHz.
- ✻✻ Specification at 2500 MHz.
- A. Environmental specifications and re-flow soldering information available in General Information Section.
- B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Minimum gain at highest frequency. Full temperature range, except room temperature for Dash-4 and Dash-5 models.
- 2. Model number designated by color dot or alphanumeric code marking.
- 3. Frequency at which output power, NF and IP3 are specified: 500 MHz for MAR-1SM, MAR-6SM, RAM-1, RAM-6, MAV-11SM, VAM-6, 1000 MHz for all other models.
- 4. Dash-5 and Dash-6 models potentially unstable with very high VSWR terminations.
- 5. Minimum output at 1 dB compression: +16.0 dBm for MAV-5SM at room temperature.

### marking identification

| Model | Alphanumeric Code | OR | Color Dot |
|---|---|---|---|
| MAR-1SM | A01 | | Brown |
| MAR-2SM | A02 | | Red |
| MAR-3SM | A03 | | Orange |
| MAR-4SM | A04 | | Yellow |
| MAR-6SM | A06 | | White |
| MAR-7SM | A07 | | Violet |
| MAR-8SM | A08 | | Blue |
| RAM-1 | 1 | | — |
| RAM-2 | 2 | | — |
| RAM-3 | 3 | | — |
| RAM-4 | 4 | | — |
| RAM-6 | 6 | | — |
| RAM-7 | 7 | | — |
| RAM-8 | 8 | | — |
| MAV-1SM | 1 | | — |
| MAV-2SM | 2 | | — |
| MAV-3SM | 3 | | — |
| MAV-4SM | 4 | | — |
| MAV-5SM | 5 | | — |
| MAV-11SM | A | | — |
| VAM-3 | A03 | | — |
| VAM-6 | A06 | | — |
| VAM-7 | A07 | | — |

### pin connections

| PORT | cb | hj |
|---|---|---|
| RF IN | 1 | 3 |
| RF OUT | 3 | 6 |
| DC | 3 | 1 |
| GND EXT | 2,4 | 2,4,5,7,8 |
| NOT USED | — | — |

***DESIGNER'S KITS AVAILABLE SEE PAGES 16&17***

### NSN GUIDE

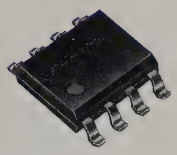
| MCL NO. | NSN |
|---|---|
| MAR-1SM | 5962-01-414-8635 |
| MAR-3SM | 5962-01-423-1569 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

* RAM

VAM



VNA

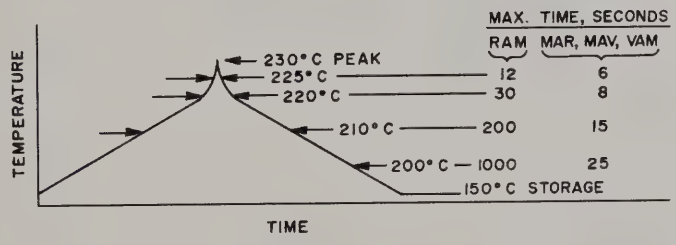
## up to +18.2 dBm output

| MODEL NO. | ✪FREQ. MHz | GAIN, dB Typical (at MHz) 100 | 1000 | 2000 | note 1 MIN. | MAXIMUM POWER, dBm Typ Output (1 dB Comp.) | Input (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR Typ. In | Out | MAXIMUM RATING (25 °C) I (mA) | P (mW) | DC POWER at Pin 3 Current (mA) | Volt Typ. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price❖ $ (QTY 30) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * RAM-1 | DC-1000 | 19.0 | 15.5 | — | 13.0 | +1.5 | +13 | 5.5 | +14.0 | 1.3:1 | 1.3:1 | 40 | 200 | 17 | 5.00 | 3-22 | AF190 | cb | 4.95 |
| * RAM-2 | DC-2000 | 12.5 | 11.8 | 11.0 | 8.5 | +4.5 | +13 | 6.5 | +17.0 | 1.2:1 | 1.4:1 | 60 | 325 | 25 | 5.00 | 3-22 | AF190 | cb | 4.95 |
| * RAM-3 | DC-2000 | 12.5 | 12.0 | 10.5 | 8.0 | +10.0 | +13 | 6.0 | +23.0 | 1.6:1 | 1.7:1 | 80 | 425 | 35 | 5.00 | 3-22 | AF190 | cb | 4.95 |
| * RAM-4 | DC-1000 | 8.5 | 8.0 | — | 7.0 | +12.5 | +13 | 6.5 | +25.5 | 1.4:1 | 1.9:1 | 100 | 540 | 50 | 5.25 | 3-23 | AF190 | cb | 4.95 |
| * RAM-6 | DC-2000 | 20.0 | 16.0 | 11.0 | 9.0 | +2.0 | +13 | 2.8 | +14.5 | 1.4:1 | 1.3:1 | 50 | 200 | 16 | 3.50 | 3-23 | AF190 | cb | 4.95 |
| * RAM-7 | DC-2000 | 13.5 | 12.5 | 11.0 | 8.5 | +5.5 | +13 | 4.5 | +19.0 | 2.0:1 | 1.8:1 | 60 | 275 | 22 | 4.00 | 3-23 | AF190 | cb | 4.95 |
| * RAM-8 | DC-1000 | 32.5 | 23.0 | — | 19.0 | +12.5 | +13 | 3.0 | +27.0 | # | # | 65 | 420 | 36 | 7.80 | 3-24 | AF190 | cb | 4.95 |
| VAM-3 | DC-2000 | 11.5 | 11.0 | 9.5 | 7.5 | +9.0 | +13 | 6.0 | +22.0 | 1.5:1 | 1.7:1 | 60 | 240 | 35 | 4.70 | 3-26 | MMM168 | cb | 1.19 |
| VAM-6 | DC-2000 | 19.5 | 15.0 | 10.0 | 8.0 | +2.0 | +13 | 3.0 | +14.0 | 1.6:1 | 1.5:1 | 40 | 125 | 16 | 3.30 | 3-26 | MMM168 | cb | 1.16 |
| VAM-7 | DC-2000 | 13.0 | 12.0 | 9.8 | 7.8 | +5.5 | +13 | 5.0 | +18.0 | 1.5:1 | 1.5:1 | 50 | 175 | 22 | 3.80 | 3-26 | MMM168 | cb | 1.31 |
| VNA-25 | 500-2500 | *14.0 | 18.0 | | **16.0 | 11.5 | +18.2 | +10 | 5.5 | +27.0 | 1.5:1☆ | 1.6:1 | 105 | 1000 | 85 | 5.0▮ | — | XX211 | hj | 4.25 |

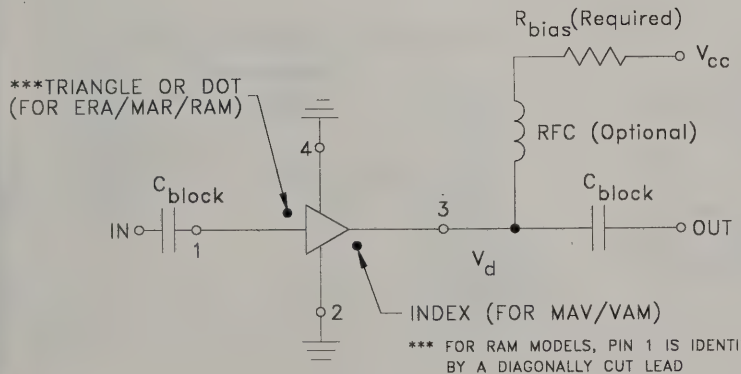
## features

- cascadable
- excellent repeatability
- wide bandwidth, DC to 2500 MHz
- unconditionally stable, most models
- low cost
- hermetically sealed, RAM models
- low noise figure, 2.8 dB typ
- high output power, up to +18 dBm typ

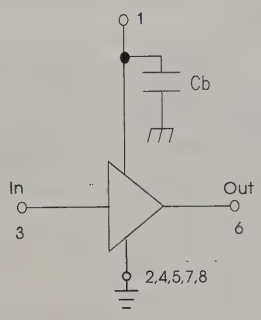
REFLOW - SOLDERING PROFILE




Typical Biasing Configuration
ERA/MAR/MAV/RAM/VAM




Biasing Configuration
**VNA**
V SUPPLY

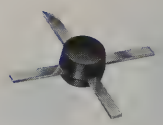



**In Stock... Immediate Delivery**

For Custom Versions Of Standard Models Consult Our Applications Dept.

# MONOLITHIC AMPLIFIERS 50 Ω

## BROADBAND DC to 2 GHz



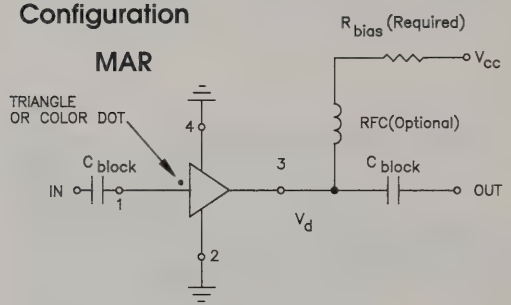
MAR

### up to +12.5 dBm output

| MODEL NO. | ✪FREQ. MHz $f_L$ | $f_U$ | GAIN, dB Typical (at MHz) 100 | 500 | 1000 | 2000 | note 1 MIN. | MAXIMUM POWER, dBm Typ. Output (1 dB Comp.) | Input (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR Typ. In | Out | MAXIMUM RATING (25 °C) I (mA) | P (mW) | DC POWER at Pin 3 Current (mA) | Volt Typ. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ (Qty 30) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ❑ MAR-1 | DC | 1000 | 18.5 | 17.5 | 15.5 | — | 13.0 | +1.5 | +13 | 5.5 | +14.0 | 1.3:1 | 1.3:1 | 40 | 200 | 17 | 5.00 | 3-22 | VV105 | cb | 0.99 |
| ❑ MAR-2 | DC | 2000 | 12.5 | 12.3 | 12.0 | 11.0 | 8.5 | +4.5 | +13 | 6.5 | +17.0 | 1.3:1 | 1.4:1 | 60 | 325 | 25 | 5.00 | 3-22 | VV105 | cb | 1.12 |
| ❑ MAR-3 | DC | 2000 | 12.5 | 12.2 | 12.0 | 10.5 | 8.0 | +10.0 | +13 | 6.0 | +23.0 | 1.5:1 | 1.7:1 | 70 | 400 | 35 | 5.00 | 3-22 | VV105 | cb | 1.19 |
| ❑ MAR-4 | DC | 1000 | 8.3 | 8.2 | 8.0 | — | 7.0 | +12.5 | +13 | 6.5 | +25.5 | 1.6:1 | 2.0:1 | 85 | 500 | 50 | 5.25 | 3-23 | VV105 | cb | 1.29 |
| ❑ MAR-6 | DC | 2000 | 20.0 | 18.5 | 16.0 | 11.0 | 9.0 | +2.0 | +13 | 3.0 | +14.5 | 1.5:1 | 1.4:1 | 50 | 200 | 16 | 3.50 | 3-23 | VV105 | cb | 1.66 |
| ❑ MAR-7 | DC | 2000 | 13.5 | 13.1 | 12.5 | 11.0 | 8.5 | +5.5 | +13 | 5.0 | +19.0 | 1.4:1 | 1.5:1 | 60 | 275 | 22 | 4.00 | 3-23 | VV105 | cb | 1.31 |
| ❑ MAR-8 | DC | 1000 | 32.5 | 28.0 | 22.5 | — | 19.0 | +12.5 | +13 | 3.3 | +27.0 | # | # | 65 | 500 | 36 | 7.80 | 3-24 | VV105 | cb | 1.27 |

### Typical Biasing Configuration

MAR




NOTES:

** Typical gain at 1500 MHz

❑ Non-hermetic

# Dash-8 models input and output impedances are not 50 ohms, see S-parameter data. Conditionally stable, source and load VSWR<3:1 required. Dash-6 models conditionally stable, source and load VSWR<5:1 required.

✪ Low frequency cutoff determined by external coupling capacitors.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

D. For Quality Control Procedures see Table of Contents, Section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see Amplifier Selection Guide.

1. Minimum gain at highest frequency. Full temperature range, except room temperature for Dash-4 models.
2. Model number designated by color dot or alphanumeric code marking.
3. Frequency at which output power, NF and IP3 are specified: 500MHz for MAR-1, MAR-6, MAV-1, MAV-11, 1000MHz for all other models.
4. Dash-6 models potentially unstable with very high VSWR terminations.

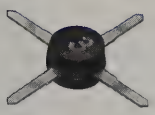
***DESIGNER'S KITS AVAILABLE SEE PAGES 16&17***

## marking identification

| Model | Alphanumeric Code | OR | Color Dot |
|---|---|---|---|
| MAR-1 | A01 | | Brown |
| MAR-2 | A02 | | Red |
| MAR-3 | A03 | | Orange |
| MAR-4 | A04 | | Yellow |
| MAR-6 | A06 | | White |
| MAR-7 | A07 | | Violet |
| MAR-8 | A08 | | Blue |
| MAV-1 | 1 | | — |
| MAV-2 | 2 | | — |
| MAV-3 | 3 | | — |
| MAV-4 | 4 | | — |
| MAV-11 | A | | — |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



MAV

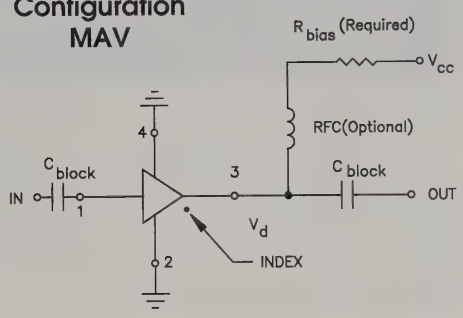
## up to +17.5 dBm output

| MODEL NO. | ✪FREQ. MHz $f_L$ | $f_u$ | GAIN, dB Typical (at MHz) 100 | 500 | 1000 | 2000 | note 1 MIN. | MAXIMUM POWER, dBm Typ Output (1 dB Comp.) | input (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR Typ. In | Out | MAXIMUM RATING (25 °C) I (mA) | P (mW) | DC POWER at Pin 3 Current (mA) | Volt Typ. | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ (QTY 30) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ❑ MAV-1 | DC- | 1000 | 18.5 | 17.0 | 15.0 | — | 12.5 | +1.5 | +13 | 5.5 | +14.0 | 1.4:1 | 1.3:1 | 40 | 200 | 17 | 5.00 | 3-24 | BBB123 | cb | 0.99 |
| ❑ MAV-2 | DC- | 1500 | 12.5 | 12.0 | 11.0 | 10.0** | 7.5 | +4.5 | +13 | 6.5 | +17.0 | 1.3:1 | 1.4:1 | 60 | 325 | 25 | 5.00 | 3-24 | BBB123 | cb | 1.12 |
| ❑ MAV-3 | DC- | 1500 | 12.5 | 12.0 | 11.0 | 10.0** | 7.5 | +10.0 | +13 | 6.0 | +23.0 | 1.3 | 1.6:1 | 70 | 400 | 35 | 5.00 | 3-25 | BBB123 | cb | 1.19 |
| ❑ MAV-4 | DC- | 1000 | 8.3 | 8.0 | 7.5 | — | 7.0 | +11.5 | +13 | 7.0 | +24.5 | 1.4:1 | 1.8:1 | 85 | 500 | 50 | 5.25 | 3-25 | BBB123 | cb | 1.29 |
| ❑ MAV-11 | 50- | 1000 | 12.7 | 12.0 | 10.5 | — | 9.0 | +17.5 | +13 | 3.6 | +30.0 | 1.5:1 | 1.7:1 | 80 | 550 | 60 | 5.50 | 3-25 | BBB123 | cb | 1.57 |

## features

- cascadable
- excellent repeatability
- wide bandwidth DC-2000 MHz
- unconditionally stable, except MAR-6, MAR-8
- low cost, MAR, MAV models
- low noise figure, 2.8 to 3.6 dB typ. MAR-6, MAR-8, MAV-11
- high output power, +17 dBm typ., MAV-11

## Typical Biasing Configuration MAV



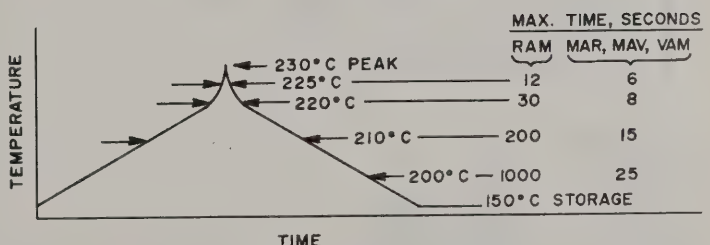

## pin connections

| PORT | cb |
|---|---|
| RF IN | 1 |
| RF OUT | 3 |
| DC | 3 |
| CASE GND | 2,4 |
| NOT USED | — |

## NSN GUIDE

| MCL NO. | NSN |
|---|---|
| MAR-2 | 5962-01-417-4110 |
| MAR-3 | 5962-01-339-2933 |
| MAR-4 | 5962-01-414-8631 |
| MAR-6 | 5962-01-416-1462 |
| MAR-8 | 5998-01-360-6957 |
| MAV-4 | 5996-01-365-2246 |
| MAV-11 | 5998-01-360-6958 |

## REFLOW - SOLDERING PROFILE




CAPD now available! computer-automated performance data

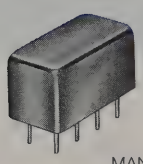
## In Stock... Immediate Delivery

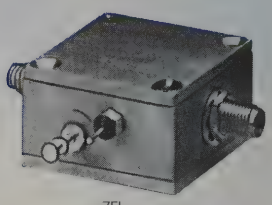
For Custom Versions Of Standard Models Consult Our Applications Dept.

# LOW-NOISE AMPLIFIERS 50 Ω

## BROADBAND, LINEAR 0.1 to 2400 MHz

AMP


MAN


ZFL

### up to +16 dBm output

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | NF dB Typ. | GAIN, dB Min. | GAIN, dB Flatness m | GAIN, dB Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | INTERCEPT POINT, dBm IP3 Typ. | VSWR Typ. In | VSWR Typ. Out | DC POWER Volt V. | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMP-11-2 | 5 | 1000 | 3 | 14 | ±1.0 | ±1.0 | -3.5 | +13 | +13 | 2:1 | 2:1 | 15 | 12 | 3-27 | PP120 | cd | 44.95 |
| AMP-15 | 5 | 1000 | 2.8 | 13 | ±0.6 | ±1.2 | +8 | +13 | +22 | 2:1 | 2:1 | 15 | 29 | 3-27 | PP120 | cd | 49.95 |
| AMP-75 | 5 | 500 | 2.4 | 19 | ±0.4 | ±1.0 | +12 | +13 | +28 | 2:1 | 2:1 | 15 | 29 | 3-27 | PP120 | cd | 49.95 |
| AMP-76 | 5 | 500 | 3.1 | 26 | ±0.7 | ±1.0 | +13.5 | +6 | +28 | 2:1 | 2:1 | 15 | 68 | 3-35 | PP120 | cd | 78.95 |
| AMP-77 | 5 | 500 | 3.3 | 15 | ±0.4 | ±1.0 | +16 | +13 | +32 | 2:1 | 2:1 | 15 | 56 | 3-28 | PP120 | cd | 55.95 |
| MAN-1LN** | 0.5 | 500 | 3.0 | 28 | ±0.5 | ±1.4 | +7 | +15 | +18 | 1.8:1 | 1.8:1 | 12 | 60 | 3-28 | A05 | cc | 19.95 |
| MAN-1HLN | 10 | 500 | 3.7 | 10 | ±0.5 | ±0.8 | +15 | +15 | +30 | 1.8:1 | 1.8:1 | 12 | 70 | 3-28 | A06 | cc | 19.95 |
| ZFL-500HLN | 10 | 500 | 3.8 | 19 | — | ±0.4 | +16 | +15 | +30 | 2:1 | 2:1 | 15 | 110 | 3-29 | Y460 | - | 99.95 |
| ZFL-500LN* | 0.1 | 500 | 2.9 | 24 | — | ±0.5 | +5 | +5 | +14 | 1.5:1 | 1.6:1 | 15 | 60 | 3-29 | Y460 | - | 79.95 |
| ZFL-1000LN | 0.1 | 1000 | 2.9 | 20 | — | ±0.5 | +3 | +5 | +14 | 1.5:1 | 2:1 | 15 | 60 | 3-29 | Y460 | - | 89.95 |

m = mid range ($2 f_L$ to $f_U/2$)

### features

- ideal for printed-circuit designs (MAN & AMP series)
- smooth response over entire band, no external resonances
- low impedance, less susceptible to EMI
- easy to use, 50 ohm input/output
- all models are cascadable

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| AMP-15 | 5895-01-350-9550 |
| AMP-75 | 5895-01-350-9551 |
| AMP-77 | 5895-01-350-9549 |
| ZFL-1000LN | 5996-01-412-3031 |

NOTES:

* VSWR 1.6:1 maximum from 0.1 to 0.2 MHz. Also available with BNC connectors.

** Below 5 MHz, 1 dB compression point decreases to 6.5 dBm.

△ Available only with SMA connectors

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

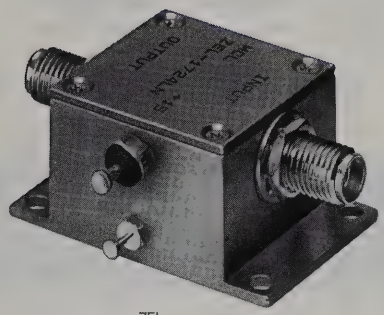
D. For Quality Control Procedures see Table of Contents, Section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see Amplifier Selection Guide.

1. Absolute maximum power, voltage and current rating:
   1a. AMP models, 17V DC.
   1b. MAN models, 12.5V DC.
2. With no load at output, derates maximum input power (no damage) by 10 dB.
3. ZEL and TO models, NF specified at room temperature, increases to 2 dB typical at +85 deg.C.
4. ZHL models, NF specified at room temperature, increases to 2.3 dB maximum at +65 deg.C.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

TO




ZEL

ZHL

## up to +26 dBm output

| MODEL NO. | FREQ. MHz $f_L$ | $f_U$ | NF dB Max. | GAIN, dB Min. | Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) | Input (no damage) | INTERCEPT POINT, dBm IP3 Typ. | VSWR Typ. In | Out | DC POWER Volt V. | Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TO-0812LN | 800 | 1200 | 1.6 | 20 | ±1.0 | +8 | +13 | +18 | 2.5:1 | 2.5:1 | 15 | 70 | 3-30 | QQ96 | ce | 199.00 |
| TO-1217LN | 1200 | 1700 | 1.6 | 20 | ±1.0 | +10 | +13 | +25 | 2.5:1 | 2.5:1 | 15 | 70 | 3-30 | QQ96 | ce | 199.00 |
| TO-1724LN | 1700 | 2400 | 1.6 | 20 | ±1.0 | +10 | +13 | +22 | 2.5:1 | 2.5:1 | 15 | 70 | 3-30 | QQ96 | ce | 199.00 |
| △ ZEL-0812LN | 800 | 1200 | 1.5 | 20 | ±1.0 | +8 | +13 | +18 | 2.5:1 | 2.5:1 | 15 | 70 | 3-31 | EEE132 | - | 274.95 |
| △ ZEL-1217LN | 1200 | 1700 | 1.5 | 20 | ±1.0 | +10 | +13 | +25 | 2.5:1 | 2.5:1 | 15 | 70 | 3-31 | EEE132 | - | 274.95 |
| △ ZEL-1724LN | 1700 | 2400 | 1.5 | 20 | ±1.0 | +10 | +13 | +22 | 2.5:1 | 2.5:1 | 15 | 70 | 3-31 | EEE132 | - | 274.95 |
| △ ZHL-0812HLN | 800 | 1200 | 1.5 | 30 | ±1.0 | +26 | +10 | +36 | 2.4:1 | 2.4:1 | 15 | 725 | 3-32 | NN92 | - | 399.50 |
| △ ZHL-1217HLN | 1200 | 1700 | 1.5 | 30 | ±1.0 | +26 | +10 | +36 | 2.4:1 | 2.4:1 | 15 | 725 | 3-32 | NN92 | - | 399.50 |
| △ ZHL-1724HLN | 1700 | 2400 | 1.5 | 30 | ±1.0 | +26 | +10 | +36 | 2.4:1 | 2.4:1 | 15 | 725 | 3-32 | NN92 | - | 399.50 |

## features

- very low noise
- high dynamic range (ZHL-HLN series)
- ideal for printed-circuit designs (TO series)
- smooth response over entire band, no external resonance
- easy to use, 50 ohms input/output
- all models are cascadable

## pin connections

| PORT | cc | cd | ce |
|---|---|---|---|
| RF IN | 1 | 2 | 5 |
| RF OUT | 8 | 4 | 11 |
| DC | 5 | 1 | 2 |
| CASE GND | 2,3,4,6 | 3 | 1,3,4,6,7,8,9,10,12 |
| NOT USED | 7 | — | — |

CAPD now available! computer-automated performance data

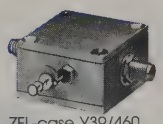
In Stock... Immediate Delivery

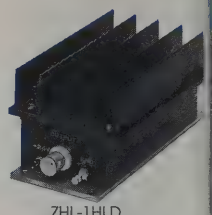
For Custom Versions Of Standard Models Consult Our Applications Dept.

AMP-case QQ96

AMP-case PP120

MAN


ZFL-case Y39/460


ZHL-1HLD

## VARIABLE GAIN 10 to 1200 MHz

up to 20 mW (+13 dBm) output

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. | GAIN, dB Control range | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE NF dB Typ. | DYNAMIC RANGE IP3 dBm Typ. | VSWR In | VSWR Out | DC POWER Volt V. | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZFL-1000GH * | 10-1200 | | 24 | ±1.5 | 30** | +13 | +10 | 15 | +25 | 2.2:1 | 2:1 | 15 | 170 | 3-33 | Y39 | - | 219.00 |
| ZFL-1000G * | 10-1000 | | 17 | ±1.5 | 30** | +3 | +10 | 12 | +13 | 2:1 | 2:1 | 15 | 100 | 3-33 | Y39 | - | 199.00 |

* ZFL-1000GH and ZFL-1000G, all specifications at 0 Volts control voltage.
** Response time (10% to 90%) 25µsec., control voltage 0 to 5 volts.

## HIGH ISOLATION 2 to 2000 MHz

up to 500 mW (+27 dBm) output

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. m | GAIN, dB Flatness Max. Total Range | MAX. POWER, dBm Output (1 dB Comp.) $L_W$ | MAX. POWER, dBm Output (1 dB Comp.) U | MAX. POWER, dBm Input (no damage) | DYNAMIC RANGE NF dB Typ. | DYNAMIC RANGE IP3 dBm Typ. | VSWR (Typ.) In | VSWR (Typ.) Out | ACTIVE DIRECTIVITY* dB $L_W$ Typ. | ACTIVE DIRECTIVITY* dB $L_W$ Min. | ACTIVE DIRECTIVITY* dB U Typ. | ACTIVE DIRECTIVITY* dB U Min. | DC POWER Volt V. | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAN-1AD | 5-500 | | 16 | ±0.5 | ±1.0 | +7 | +6 | +15 | 7.2 | +20 | 1.6:1 | 1.7:1 | 35 | 25 | 30 | 20 | 12 | 85 | 3-34 | A05 | cc | 26.45 |
| MAN-11AD | 2-2000 | | 8 | ±0.5 | ±1.5 | -2 | -3.5 | +10 | 6.5 | +14 | 3.0:1 | 2.0:1 | 21 | 14 | 16 | 12 | 15 | 22 | 3-34 | A06 | cc | 31.95 |
| MAN-2AD | 2-1000 | | 9 | ±0.4 | ±0.7 | -2 | -2 | +10 | 6.5 | +14 | 2.0:1 | 2.0:1 | 24 | 19 | 19 | 14 | 15 | 22 | 3-34 | A06 | cc | 23.95 |
| ZFL-11AD | 2-2000 | | 8 | ±0.5 | ±1.3 | -2 | -3.5 | +10 | 6.5 | +14 | 2.5:1 | 2.0:1 | 21 | 14 | 16 | 12 | 15 | 22 | 3-34 | Y39 | - | 91.95 |
| ZFL-2AD | 2-1000 | | 10 | ±0.4 | ±0.5 | -2 | -2 | +10 | 6.5 | +14 | 2.0:1 | 2.0:1 | 24 | 19 | 19 | 14 | 15 | 22 | 3-34 | Y39 | - | 83.95 |
| ZFL-1HAD** | 10-500 | | 10 | — | ±1.0 | +20 | +20 | +17 | 7.5 | +30 | 1.3:1 | 1.35:1 | 30 | 20 | 25 | 18 | 15 | 115 | 3-35 | SS98 | - | 210.00 |
| NEW ZFL-2HAD*** | 50-1000 | | 11 | ±0.7 | ±1.0 | +20 | +20 | +15 | 5.0 | +33 | 2.0:1 | 2.0:1 | 30 | 20 | 21 | 15 | 15 | 110 | — | SS98 | - | 264.95 |
| △ ZHL-1HLD | 225-400 | | 23 | — | ±1.0 | +27 | +27 | +10 | 2.5 | +40 | 2.0:1 | 2.0:1 | 34 | 28 | 34 | 28 | 24 | 525 | 3-35 | T34 | - | 395.00 |

$L_W$ = low range ($f_L$ to $f_U/2$) m = mid range ($2f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

* Active Directivity (dB) = Isolation (dB) - Gain (dB)
** Input VSWR of ZFL-1HAD in 10-20 MHz band increases to 1.45:1 at -55 deg.C. Below 50 MHz, NF increases to 11 dB typ at 10 MHz.
*** ZFL-2HAD can be used without the heatsink

NOTES:
✤ Hermetically sealed with field replaceable connectors.
✤ Max. voltage Vdc
▲ Available only with BNC connectors
△ Available only with SMA connectors
▼ SMA standard: Also available with BNC or type N connectors, please consult factory.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
D. For Quality Control Procedures see Table of Contents, Section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see Amplifier Selection Guide.
1. Absolute maximum power, voltage and current rating:
   1a. AMP models, 17V DC
   1b. MAN models, 12.5V DC
   1c. ZHL models, 28V DC (except ZHL-1HAD, 17V DC)
   1d. ZFL models, 17V DC (except ZFL-AD, 16V DC)
   1e. ZJL models, 13V DC
2. With no load output, derate maximum input power (no damage) by 10 dB.

**NSN GUIDE**

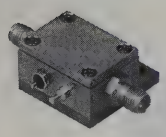
| MCL NO. | NSN |
|---|---|
| ZFL-1000H | 5895-01-299-5588 |
| ZFL-2000 | 5895-01-220-2213 |
| ZFL-2000B | 5895-01-220-2213 |
| ZHL-6A | 5895-01-330-3533 |

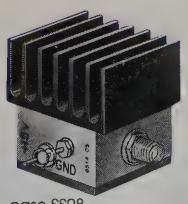
pin connections

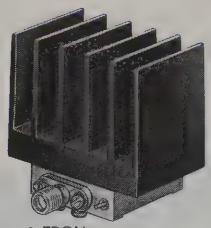
| PORT | cc | cd | ce |
|---|---|---|---|
| RF IN | 1 | 2 | 5 |
| RF OUT | 8 | 4 | 11 |
| DC | 5 | 1 | 2 |
| CASE GND | 2,3,4,6 | 3 | 1,3,4,6,7 |

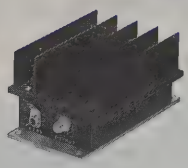


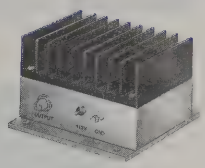

Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


ZJL


ZFL-case SS98


✤ ZRON


ZHL-A


ZHL-1042J

## LOW POWER 50 kHz to 7000 MHz

up to 16 mW (+12 dBm) output

| | MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Typ. | GAIN, dB Min. | GAIN, dB Flatness Typ.(1) | GAIN, dB Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) $L_W$ | MAXIMUM POWER, dBm Output (1 dB Comp.) U | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE(1) NF dB Typ. | DYNAMIC RANGE(1) IP3 dBm Typ. | VSWR (Typ.) In | VSWR (Typ.) Out | DC POWER Volt V. | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | ZJL-7G | 20-7000 | | 10.2 | 6.5 | 1.2 | -- | +11 | +9 | +13 | 7.0 | +27 | 1.5:1 | 1.5:1 | 12 | 60 | -- | BW459 | - | 99.95 |
| NEW | ZJL-6G | 20-6000 | | 13.4 | 9.5 | 1.5 | -- | +12 | +10 | +13 | 6.0 | +27 | 1.3:1 | 1.5:1 | 12 | 60 | -- | BW459 | - | 114.95 |
| NEW | ZJL-3G | 20-3000 | | 19.8 | 15.0 | 1.6 | -- | +8 | +8 | +13 | 4.5 | +18 | 1.4:1 | 1.6:1 | 12 | 45 | -- | BW459 | - | 114.95 |
| ▼ | ZFL-500 | 0.05-500 | | -- | 20 | -- | ±1.0 | -- | +9 | +5 | 5.3 | +18 | 1.9:1 | 1.9:1 | 15 | 80 | 3-37 | Y460 | - | 69.95 |
| | ZFL-750 | 0.2-750 | | -- | 18 | -- | ±0.5 | -- | +9 *** | +5 | 6.0 | +18 | 1.5:1 | 2:1 | 15 | 90 | 3-37 | Y460 | - | 74.95 |
| | ZFL-1000 | 0.1-1000 | | -- | 17 | -- | ±0.6 | -- | +9 * | +5 | 6.0 | +18 | 1.5:1 | 2:1* | 15 | 105 | 3-37 | Y460 | - | 79.95 |
| | AMP-3G | 30-3000 | | -- | 8 | -- | ±0.75 | +9.5 | +9.5 | +13 | 3.5** | +20 | 2.6:1 | 2.5:1 | 15 | 55 | 3-38 | PP120 | cd | 89.95 |
| | AMP-74 | 5-500 | | -- | 27 | -- | ±1.0 | +7.0 | +7.0 | +13 | 5.0 | +20 | 2:1 | 2:1 | 15 | 44 | 3-36 | PP120 | cd | 54.95 |
| | MAN-1 | 0.5-500 | | -- | 28 | -- | ±1.4 | +8 | +8 | +15 | 4.5 | +18 | 1.8:1 | 1.8:1 | 12 | 60 | 3-36 | A05 | cc | 15.95 |
| | MAN-2 | 0.5-1000 | | -- | 18 | -- | ±1.5 | +9 | +7 | +15 | 6.0 | +19 | 1.8:1 | 1.8:1 | 12 | 85 | 3-36 | A05 | cc | 19.95 |

$L_W$ = low range ($f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

* ZFL-1000 output VSWR 2.8:1 maximum over 750-1000 MHz; 1 dB compression +7 dBm at 500-1000 MHz.
** NF increases with decreasing frequency, 5 dB typical at 300 MHz, and 10 dB typical at 30 MHz.
*** +7 dBm from 500 to 750 MHz.
(1) ZJL models: Flatness specified to 0.75 $f_U$, dynamic range at 2 GHz.

## MEDIUM POWER 2.5 kHz to 8000 MHz

up to 400 mW (+25 dBm) output

| | MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Typ. | GAIN, dB Min. | GAIN, dB Flatness Typ.(1) | GAIN, dB Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE(1) NF dB Typ. | DYNAMIC RANGE(1) IP3 dBm Typ. | VSWR In | VSWR Out | DC POWER Volt V.✤ | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AMP-2000 | 10-2000 | | -- | 20 | -- | ±1.5 | +15.0 | +5 | 5 | +25 | 2:1 | 2:1 | 15 | 100 | 3-38 | QQ96 | ce | 139.95 |
| | ZFL-2000 | 10-2000 | | -- | 20 | -- | ±1.5 | +16* | +5 | 7 | +25 | 2:1 | 2:1 | 15 | 120 | 3-40 | Y39 | - | 219.00 |
| | ZFL-2500 | 500-2500 | | -- | 28 | -- | ±1.5 | +15 | +5 | 8 | +27 | 2.5:1 | 2.5:1 | 5 | 220 | -- | Y460 | - | 99.95 |
| NEW | ZFL-2500VH | 10-2500 | | -- | 20 | -- | ±1.5 | +24 | +10 | 5.5 | +35 | 1.7:1 | 2:1 | 15 | 300 | -- | SS98 | - | 264.95 |
| | ZFL-1000H | 10-1000 | | -- | 28 | -- | ±1.0 | +20 | +5 | 5 | +33 | 2:1 | 2:1 | 15 | 160 | 3-39 | SS98 | - | 219.00 |
| | ZFL-1000VH | 10-1000 | | -- | 20 | -- | ±1.0 | +25 | +15 | 4.5 | +38 | 2:1** | 2.5:1 | 15 | 320 | 3-39 | SS98 | - | 229.00 |
| ✤ | ZRON-8G | 2000-8000 | | -- | 20 | -- | ±1.5★ | +20 | +10 | 6 | +30 | 2:1 | 2:1 | 15 | 310 | -- | AV243 | - | 495.00 |
| ▲ | ZHL-6A | .0025-500 | | -- | 21 | -- | ±1.0 | +23 | +10 | 7.5*** | +34 | 1.8:1 | 2:1*** | 24 | 350 | 3-41 | S32 | - | 199.00 |
| | ZHL-1042J | 10-4200 | | -- | 25 | -- | ±1.5 | +20 | +10 | 6 | +30 | 2.5:1 | 2.5:1 | 15 | 330 | 3-40 | NN92 | - | 495.00 |
| | | | | | | | | $L_W$ | U | | | | | | | | | | |
| NEW | ZJL-4G | 20-4000 | | 12.8 | 10.0 | 0.4 | -- | +15.5 | +11 | +13 | 5.0 | +31 | 1.3:1 | 1.5:1 | 12 | 90 | -- | BW459 | - | 129.95 |
| NEW | ZJL-4HG | 20-4000 | | 17.6 | 12.0 | 1.6 | -- | +16.5 | +11 | +13 | 4.5 | +31 | 1.8:1 | 1.4:1 | 12 | 90 | -- | BW459 | - | 129.95 |

$L_W$ = low range ($f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

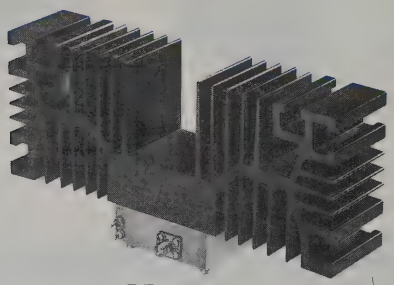
* +15 dBm below 1000 MHz
** Input VSWR 2:1 max, increasing below 20 MHz to 2.25:1 max at 10 MHz
*** NF specified above 10 MHz and output VSWR 2.2:1 above 400 MHz
★ Measured at 25°C.
(1) ZJL models: Flatness specified to 0.75 $f_U$, dynamic range at 2 GHz.

CAPD now available! computer-automated performance data

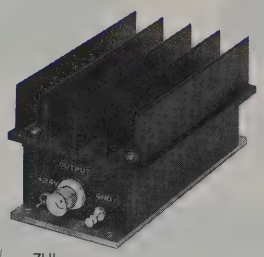
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

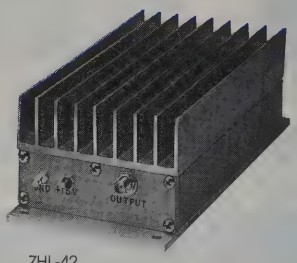
## MEDIUM HIGH POWER 50 kHz to 8 GHz



✣ ZVE



ZHL



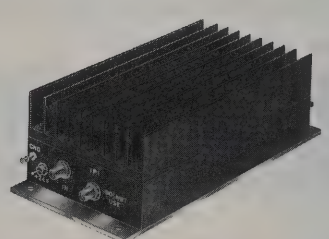
ZHL-42

### up to 1W (+30 dBm) output

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE NF dB Typ. | DYNAMIC RANGE IP3 dBm Typ. | VSWR In | VSWR Out | DC POWER Volt V | DC POWER Current (A) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ✣ ZVE-8G | 2000 | 8000 | 30 | ±2.0 | +30* | +20 | 4 | 40 | 2:1 | 2:1 | 12 | 2.0 | — | BN333 | — | 1095.00 |
| ZHL-1A | 2 | 500 | 16 | ±1.0 | +28 | +20 | 11 | +38 | 2:1 | 2.1 | 24 | 0.60 | 3-41 | S32 | — | 229.00 |
| ZHL-2 | 10 | 1000 | 16 | ±1.0 | +29 | +15 | 9 | +38 | 2:1 | 2:1 | 24 | 0.60 | 3-43 | T34 | — | 349.00 |
| ZHL-2-8 | 10 | 1000 | 27 | ±1.0 | +29 | +5 | 10 | +38 | 2:1 | 2:1 | 24 | 0.60 | 3-43 | T34 | — | 525.00 |
| △ ZHL-2-12 | 10 | 1200 | 24 | ±1.0 | +29* | +10 | 10 | +38 | 2:1 | 2:1 | 24 | 0.75 | 3-43 | T34 | — | 625.00 |
| ZHL-3A | 0.4 | 150 | 24 | ±1.0 | +29.5 | +10 | 11 | +38 | 2:1 | 2:1 | 24 | 0.60 | 3-42 | S32 | — | 229.00 |
| ZHL-32A | 0.05 | 130 | 25 | ±1.0 | +29 | +10 | 10 | +38 | 2:1 | 2:1 | 24 | 0.60 | 3-42 | S32 | — | 229.00 |
| ZHL-42 | 700 | 4200 | 30 | ±1.0 ★ | +28 | +5 | 10 | +38 | 2.5:1 | 2.5:1 | 15 | 0.88 | 3-44 | U36 | — | 895.00 |
| ZHL-4240 | 700 | 4200 | 40 | ±1.5 ★ | +28 | -5 | 8 | +38 | 2.5:1 | 2.5:1 | 15 | 0.90 | 3-45 | U36 | — | 1395.00 |
| ZHL-42W | 10 | 4200 | 30 | ±1.5 ★ | +28** | 0 | 8*** | +38 | 2.5:1 | 2.5:1 | 15 | 0.88 | 3-44 | U36 | — | 1095.00 |
| ZHL-4240W | 10 | 4200 | 40 | ±1.5 ★ | +28** | -5 | 8*** | +38 | 2.5:1 | 2.5:1 | 15 | 0.90 | 3-45 | U36 | — | 1495.00 |

* +28.5 dBm maximum at 1000-1200 MHz
** +27 dBm at 10-700 MHz
*** Below 100 MHz NF increases to 15 dB at 10 MHz

☆ At +25°C, +29 dBm typ. at 90°C case
★ Measured at 25°C.



ZHL-50P3

### feed-forward, low-distortion

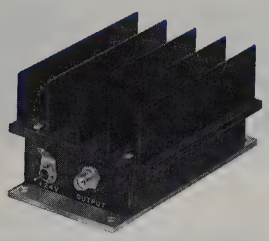
| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. | MAX. POWER, dBm Output (1 dB Comp.) | MAX. POWER, dBm Input (no damage) | DYNAMIC RANGE NF dB Typ. | DYNAMIC RANGE Intercept Point dBm, Min 2nd** order In-Band | DYNAMIC RANGE Intercept Point dBm, Min 3rd* order | VSWR In/Out | DC POWER Volt V. | DC POWER Current (A) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZHL-1-50P3 | 50 | 500 | 22 | ±1.0 | +27*** | +15 | 7 | +70 | +50 | 1.5:1 | 24 | 1.30 | 3-47 | U200 | — | 695.00 |
| ZHL-2-50P3 | 50 | 1000 | 21 | ±1.0 | +25 | +15 | 8 | +63 | +43 | 2.0:1 | 24 | 0.65 | 3-47 | U200 | — | 895.00 |

* IP3 measured at +15 dBm output each fundamental tone, at room temperature.
** IP2 +50 dBm typical for out band products.
*** +30 dBm at 50-250 MHz.

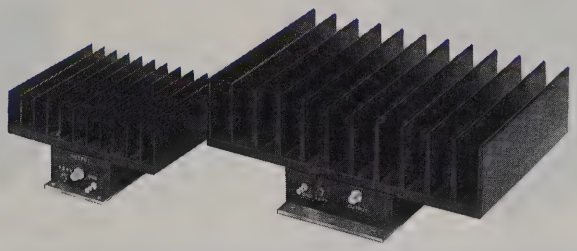


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# HIGH POWER 50 kHz to 100 MHz



ZHL-A



ZHL-2W

ZHL-3W
ZHL-5W
ZHL-10W

## up to 5W (+37 dBm) output

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE NF dB Typ. | DYNAMIC RANGE IP3 dBm Typ. | VSWR In | VSWR Out | DC POWER Volt V | DC POWER Current (A) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZHL-1-2W | 5-500 | | 29 | ±1.0 | +33 | +10 | 12 | +44 | 2:1 | 2:1 | 24 | 0.9 | 3-46 | T35 | — | 525.00 |
| ZHL-7-2W | 600-800 | | 28 | ±1.0 | +33 | +10 | 12 | +43 | 2:1 | 2:1 | 24 | 0.9 | 3-46 | T35 | — | 590.00 |
| ZHL-1000-3W | 500-1000 | | 38 | ±1.0* | +35** | 0 | 9 | +45 | 2:1 | 2.5:1 | 24 | 2.0 | 3-46 | DDD338 | — | 695.00 |
| ZHL-5W-1 | 1-500 | | 40 | ±1.5 | +37 | 0 | 9 | +49 | 2:1 | 2.5:1 | 24 | 3.3 | 3-48 | DDD131 | — | 995.00 |
| ZHL-900-10W | 480-900 | | 19 | ±1.0 | +38 | +25 | 10 | +50 | 2:1 | 2:1 | 24 | 5.5 | 3-48 | DDD338 | — | 1995.00 |

* 1.5 dB over temperature range -20 to +65 deg. C.
** +37 dBm typical

NOTES:
- ✤ Hermetically sealed with field replaceable connectors.
- ✣ Max. voltage Vdc
- △ Available only with SMA connectors
- ▲ Available only with BNC connectors
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
- D. For Quality Control Procedures see Table of Contents, Section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see Amplifier Selection Guide.
- 1. With no load output, derate maximum input power (no damage) by 10 dB, by 15 dB for ZHL-5W-1.

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| ZHL-1A | 6130-01-088-2322 |
| ZHL-1A(BNC) | 5895-01-123-0792 |
| ZHL-1A(SMA) | 5895-01-201-4500 |
| ZHL-2-12 | 5996-01-400-0753 |
| ZHL-3A | 5895-01-194-1718 |
| ZHL-32A | 5895-01-238-7973 |
| ZHL-42(SMA) | 5895-01-253-2397 |
| ZHL-1042J | 5996-01-412-3038 |
| ZHL-4240 | 5895-01-263-5871 |
| ZHL-5W-1 | 5825-01-339-2539 |

CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# HIGH POWER 0.5 to 1000 MHz

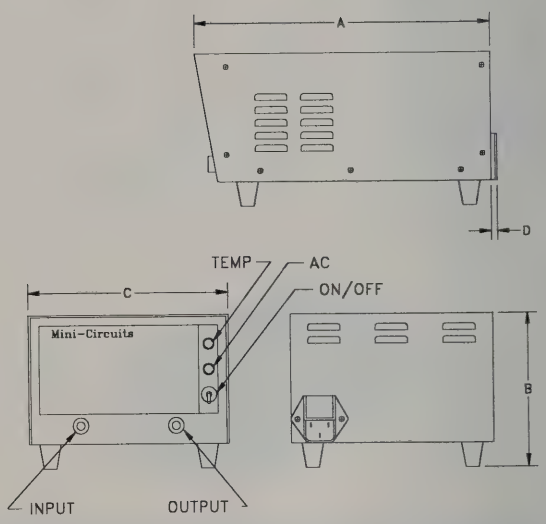
TIA

## up to 10W (+40 dBm) output

| MODEL NO. | FREQ. MHz $f_L$ | $f_U$ | GAIN, dB Min. | Flatness Max. | MAXIMUM POWER, dBm Output (1 dB Comp.) Typ. | Min. | Input Max. (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR In | Out | AC POWER Volt (Note 1) | Freq. Hz | VA max. | CAPD DATA Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIA-900-10 | 100-900 | | 28 | ±2.5 | +42 | +40 | +25 | 13 | 51 | 2.5:1 | 2.5:1 | 110 | 50/60 | 475 | See | AP176 | — | 3,695. |
| TIA-1000-4 | 100-1000 | | 19 | ±1.5 | +39 | +36 | +25 | 12 | 48 | 2.5:1 | 2.5:1 | 110 | 50/60 | 400 | Facing | AP176 | — | 1,995. |
| TIA-1000-1R8 | 0.50-1000 | | 35 | ±2.0 | +35 | +32 | +7 | 8* | 45 | 1.9:1 | 2.5:1 | 110 | 50/60 | 140 | Page | AP175 | — | 1,495. |

## features

- Wide bandwidth, 0.5-1000 MHz
- Instrument model, with built-in power supply,110/220V operation
- High Power Output, (at 3.5 dB compression)
  45 dBm TYPICAL FOR TIA-900-10
  42 dBm TYPICAL FOR TIA-1000-4
  37 dBm TYPICAL FOR TIA-1000-1R8
- High Gain, 38 dB TYPICAL FOR TIA-1000-1R8
  34 dB TYPICAL FOR TIA-900-10
- High Reverse Isolation, 80 dB TYPICAL FOR TIA-900-10
  AND TIA-1000-1R8
  55 dB TYPICAL FOR TIA-1000-4
- 100% Burn-In at +25°C, 48 hours
- Thermally self-protected, led indicator




NOTES:

* NF above 400 MHz. At low frequency, NF increases to 16 dB Typ.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

C. Prices and Specifications subject to change without notice.

1. Add dash 2 (-2) to model no. for 220V operation.
2. Gain and maximum output power specified at 25°C±5°C., over temperature, specifications degrade approximately 1dB, gain flatness ±2.5dB maximum for TIA-10001R8 and TIA-1000-4.
3. With no load, max. input (no damage) reduce by 10 dB.
4. VSWR specified at:
   350-900 MHz FOR TIA-900-10
   350-1000 MHz FOR TIA-1000-4
   340-1000 MHz FOR TIA-1000-1R8
5. Operating temperature: 0°C to +55°C.
   Storage temperature: -40°C to +70°C.
6. All TIA models are protected under U.S. patent 5, 101, 171.

## Outline drawing and dimensions.

| Case No. | | A | B | C | D | wt. grams. | NOTES |
|---|---|---|---|---|---|---|---|
| AP175 | inch | 9.8 | 5.0 | 6.7 | 0.2 | 3500 | |
| | mm | 248.9 | 127.0 | 170.2 | 5.1 | | A10,D7,G1,G2 |
| AP176 | inch | 19.5 | 6.0 | 12.5 | 0.2 | 9500 | |
| | mm | 495.3 | 152.4 | 317.5 | 5.1 | | A10,D7,G1,G2 |

A10. Case material: aluminum alloy. Finish: grey paint.
D7. Connectors: BNC only.
G1. Keep area adjacent to fan and louvers clear to permit air flow to pass. Caution: Do not insert anything especially conductors or fingers into case opening. Physical injury, shock or death may occur.
G.2 Configured for either 110 volt or 220 volt AC operation; specify when ordering.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# VERY HIGH POWER 50W, 20 to 1000MHz

LZY

up to 50W (+47 dBm) output

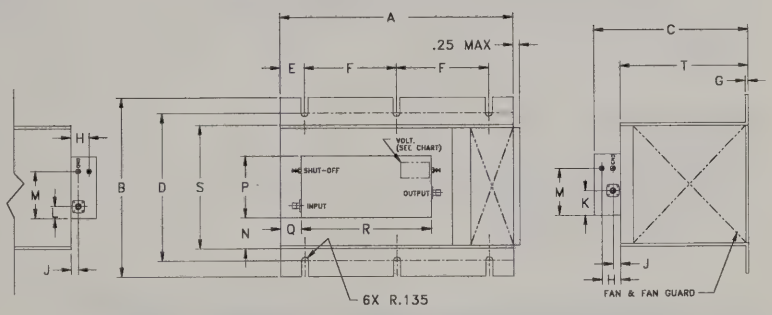
| | MODEL NO. | FREQ. MHz $f_L$ | $f_U$ | GAIN, dB Min. | Flatness Max. | POWER, dBm Min. Output (1 dB Comp.) | Max. Output (Typ.) | Max. Input (no damage) | DYNAMIC RANGE NF dB Typ. | IP3 dBm Typ. | VSWR In | Out | DC POWER Volt V. | Max Current** (A) | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W | LZY-1 | 20 | 512 | 39 | ±1.5 | +44 | +47 | +10 | 8.6* | 54 | 2.0:1 | ❇ | +26 | 7.3 | BT412 | -- | 1995.00 |
| W | LZY-2 | 500 | 1000 | 40 | ±1.5 | +43 | +45 | +10 | 8.0 | 54 | 2.0:1 | 3.5:1 | +28 | 8.0 | BT451 | -- | 2195.00 |

## features

- saturated power 50W typ. (LZY-1) and 32W typ. (LZY-2)
- high power with low distortion, -32 dBc typ. (LZY-1) and -45 dBc typ. (LZY-2) harmonics at 20 watts
- wide bandwidth, usable 10 - 525 MHz and 475 - 1050 MHz
- high gain, 42 dB typ. (LZY-1) and 47 dB typ. (LZY-2)
- unconditionally stable
- self protected against excessive drive, high case temp., reverse polarity and shorting/ unshorting transients at dc input
- electronic shutoff by grounding the shut-off terminal, reduces output by 50 dB. Open circuiting terminal restores full power within 100 μ sec.
- cool operation with integral fan, 15° C typ. rise
- graceful degradation, +20 to +30V DC
- can withstand short and open circuit at output for 2 minutes while delivering 20 watts

NOTES:

* 80-512 MHz, at 20 MHz 11.6 dB typ.
** At 25W output for LZY-1 and 20W for LZY-2; includes fan
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
C. Prices and Specifications subject to change without notice.
1. Absolute max. dc voltage: +30V
2. Operating air-ambient temp. for specified performance: -10°C to 50°C
3. Max. storage temp.: -55°C to 100°C
❇ VSWR 9:1 typ. up to 450 MHz, all specifications for 50 ohm load.




## Outline drawing and dimensions.

| Case No. | | A | B | C | D | E | F | G | H | J | K | L | M | N | P | Q | R | S | T | wt. grams | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT412 | inch | 9.50 | 7.3 | 6.3 | 6.00 | 1.00 | 3.75 | .13 | .75 | .30 | 1.00 | .48 | 1.91 | 1.3 | 2.50 | .9 | 5.30 | 5.1 | 5.2 | 4000 | A8, D17 |
| | mm | 241.30 | 185.42 | 160.02 | 152.40 | 25.40 | 95.25 | 3.30 | 19.05 | 7.62 | 25.40 | 12.18 | 48.51 | 33.02 | 63.50 | 22.86 | 134.62 | 129.54 | 132.08 | | |
| BT451 | inch | 9.50 | 7.3 | 6.3 | 6.00 | 1.00 | 3.75 | .13 | .78 | .31 | 1.48 | 1.48 | 2.45 | 1.1 | 2.95 | .5 | 6.00 | 5.1 | 5.2 | 4000 | A8, D17 |
| | mm | 241.30 | 185.42 | 160.02 | 152.40 | 25.40 | 95.25 | 3.30 | 19.81 | 7.87 | 37.59 | 37.59 | 62.23 | 27.94 | 75.00 | 12.7 | 152.40 | 129.54 | 132.08 | | |

A8. Case material: aluminum alloy. Finish: case irridite. Heat sink: black anodize.
D17. Connectors: Female SMA only.

CAPO now available! computer-automated performance data

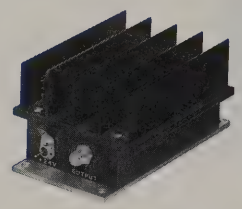
In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# PULSE AMPLIFIERS

Coaxial

## INVERTING & NON-INVERTING up to 200 mW, 2.5 KHz to 700 MHz



ZPUL

### up to 200 mW

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | GAIN, dB Min. | GAIN, dB Flatness Max. | RISE/FALL TIME ns Max | PULSE WIDTH* µs, Max. | POLARITY | MAXIMUM POWER, dBm Output (1 dB Comp.) | MAXIMUM POWER, dBm Input (no damage) | DYNAMIC RANGE NF** dB Typ. | DYNAMIC RANGE Intercept 3rd order Typ. | VSWR In | VSWR Out | DC POWER Volt V. | DC POWER Current (mA) | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style ▲ Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZPUL-21 | 0.0025 | 700 | 21 | ±1 | 1.5 | 6 | Inverting | 23 | +10 | 7.3 | 34 | 2:1 | 2:1 | 24 | 350 | — | S32 | — | 249.0 |
| ZPUL-30P | 0.0025 | 700 | 29 | ±1 | 1.5 | 6 | Non-inverting | 23 | +10 | 7.2 | 34 | 2:1 | 2:1 | 24 | 400 | — | S32 | — | 295.0 |

$L_w$ = low range ($f_L$ to $f_U/2$) m = mid range ($2f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

* pulse width for less than 10% droop
** NF tested above 10 MHz

### features

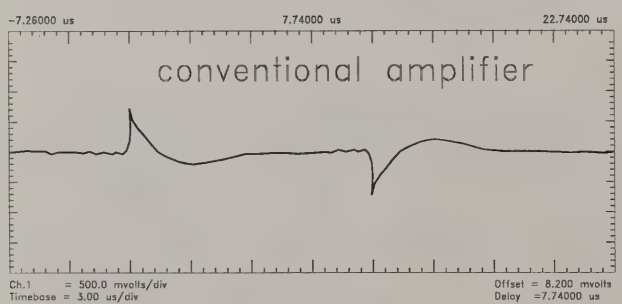
- wide bandwidth 2.5 KHz to 700 MHz, useable to 1 GHz
- excellent flatness ±0.6 dB typical
- can handle wide pulse width & (15 µs typ.) with excellent rise/fall time (1.1 ns typ.)
- inverting (ZPUL-21) & non-inverting (ZPUL-30P) configurations
- delay time, 1.5 ns typical

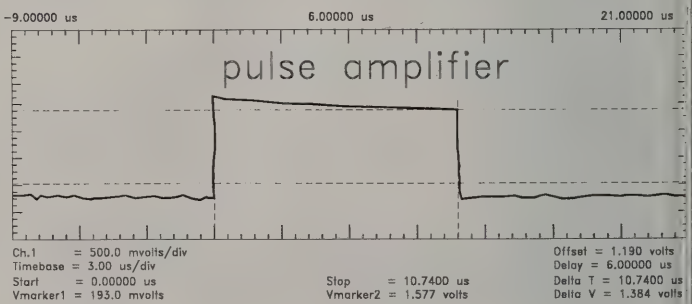
### applications

- computers
- digital communication
- medical test set-ups

NOTES:
▲ Available only with BNC connectors
A. General Quality Control Procedures, Environmental Specifications, Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are give in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Operating temperature: -20°C to 65°C
Storage temperature: -55°C to 100°C

### typical amplifier response to a pulse input

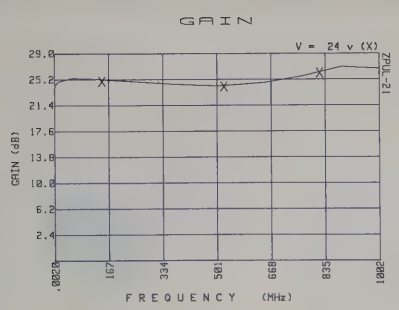


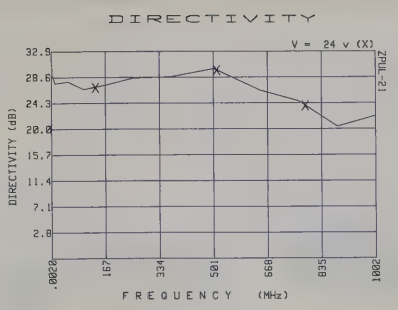



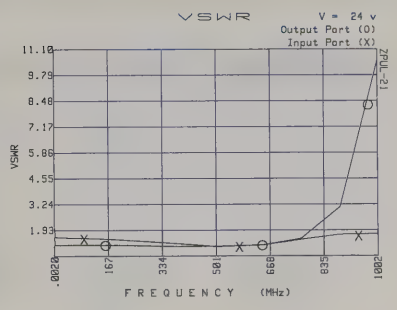



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## ZPUL-21

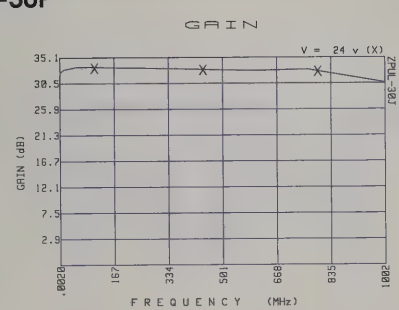


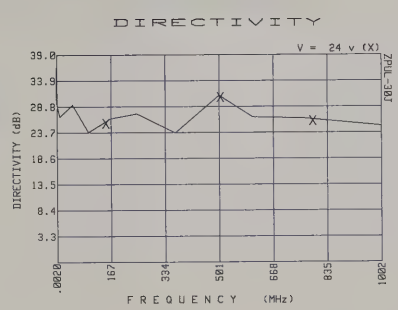



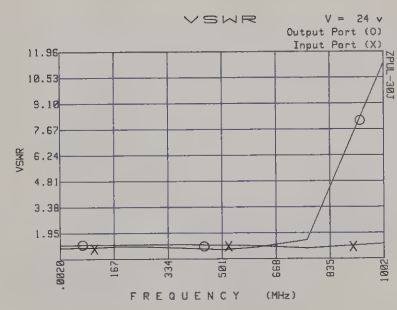




| FREQUENCY (MHz) | GAIN (dB) | DIRECTIVITY (dB) | VSWR (:1) IN | VSWR (:1) OUT | N.F. (dB) | | Pout (@1dB COMPR) (MHz) | Pout (@1dB COMPR) (dBm) |
|---|---|---|---|---|---|---|---|---|
| 0.002 | 24.14 | 30.72 | 1.85 | 1.40 | 10.00 | 7.37 | 0.002 | 24.63 |
| 0.012 | 24.47 | 29.52 | 1.61 | 1.20 | 106.00 | 7.15 | 0.012 | 24.76 |
| 0.050 | 24.42 | 29.95 | 1.58 | 1.18 | 202.00 | 7.20 | 0.050 | 24.70 |
| 1.008 | 24.43 | 28.89 | 1.58 | 1.17 | 298.00 | 7.27 | 1.008 | 24.82 |
| 10.078 | 24.92 | 27.56 | 1.57 | 1.17 | 418.00 | 7.29 | 8.930 | 25.50 |
| 50.000 | 25.41 | 27.85 | 1.54 | 1.18 | 466.00 | 7.26 | 50.000 | 25.58 |
| 98.875 | 25.40 | 26.60 | 1.52 | 1.18 | 514.00 | 7.23 | 98.875 | 25.44 |
| 167.875 | 25.17 | 27.34 | 1.48 | 1.17 | 562.00 | 7.22 | 176.500 | 25.30 |
| 251.250 | 24.92 | 28.45 | 1.39 | 1.15 | 610.00 | 7.18 | 300.125 | 24.91 |
| 366.250 | 24.56 | 28.65 | 1.26 | 1.10 | 658.00 | 7.17 | 349.000 | 24.64 |
| 501.375 | 24.29 | 30.00 | 1.09 | 1.11 | 706.00 | 7.12 | 501.375 | 24.34 |
| 645.125 | 24.76 | 26.40 | 1.18 | 1.17 | 754.00 | 7.05 | 661.750 | 24.14 |
| 763.000 | 25.71 | 24.64 | 1.45 | 1.50 | 802.00 | 6.97 | 817.625 | 23.06 |
| 883.750 | 27.09 | 20.40 | 1.70 | 3.10 | 898.00 | 6.77 | 944.125 | 20.65 |
| 1001.625 | 26.82 | 22.14 | 1.73 | 10.56 | 970.00 | 6.67 | 1073.500 | 14.21 |

## ZPUL-30P



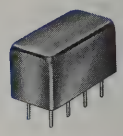

| FREQUENCY (MHz) | GAIN (dB) | DIRECTIVITY (dB) | VSWR (:1) IN | VSWR (:1) OUT | N.F. (dB) | | Pout (@1dB COMPR) (MHz) | Pout (@1dB COMPR) (dBm) |
|---|---|---|---|---|---|---|---|---|
| 0.002 | 32.16 | 32.16 | 1.53 | 1.39 | 10.00 | 7.41 | 0.003 | 24.26 |
| 0.010 | 32.60 | 32.60 | 1.32 | 1.17 | 97.00 | 7.16 | 0.050 | 24.67 |
| 0.050 | 32.49 | 32.49 | 1.30 | 1.15 | 126.00 | 7.16 | 1.026 | 24.83 |
| 0.118 | 32.47 | 32.47 | 1.31 | 1.14 | 155.00 | 7.15 | 9.866 | 25.30 |
| 1.106 | 32.51 | 32.51 | 1.30 | 1.14 | 213.00 | 7.17 | 50.000 | 25.61 |
| 10.172 | 32.98 | 32.98 | 1.29 | 1.14 | 271.00 | 7.20 | 98.875 | 25.51 |
| 50.000 | 33.45 | 33.45 | 1.30 | 1.15 | 329.00 | 7.23 | 133.375 | 25.36 |
| 98.875 | 33.48 | 33.48 | 1.31 | 1.15 | 416.00 | 7.24 | 297.250 | 24.96 |
| 167.875 | 33.35 | 33.35 | 1.31 | 1.21 | 503.00 | 7.23 | 377.750 | 24.42 |
| 248.375 | 33.28 | 33.28 | 1.32 | 1.21 | 561.00 | 7.21 | 501.375 | 24.38 |
| 366.250 | 33.13 | 33.13 | 1.32 | 1.14 | 619.00 | 7.20 | 541.625 | 24.06 |
| 501.375 | 32.91 | 32.91 | 1.29 | 1.04 | 706.00 | 7.16 | 625.000 | 23.98 |
| 604.785 | 32.81 | 32.81 | 1.25 | 1.16 | 793.00 | 7.20 | 708.375 | 23.89 |
| 763.000 | 33.01 | 33.01 | 1.11 | 1.57 | 909.00 | 7.29 | 872.250 | 23.46 |
| 1001.625 | 30.68 | 30.68 | 1.35 | 11.38 | 996.00 | 7.24 | 952.750 | 20.75 |

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

## BI-PHASE 1 MHz to 2 GHz

TFAS

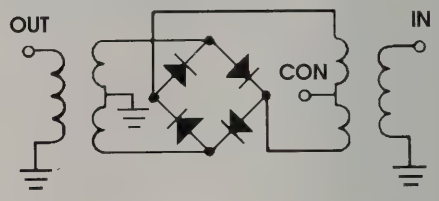

PAS
GAS

| MODEL NO. | FREQUENCY MHz IN $f_L$-$f_U$ | CON | INSERTION LOSS dB (±20 mA) Mid-Band m Typ. | Mid-Band m Max. | Total Range Typ. | Total Range Max. | MAX. INPUT POWER dBm (±20 mA) 1 dB comp. | no damage | IN-OUT ISOLATION dB (0 mA) L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | BI-PHASE $\overline{X}$ (±20 mA) Typ. Δ AMP (dB) m | Δ AMP (dB) Total Range | Phase(deg) Deviation From 180° m | Phase(deg) Deviation From 180° Total Range | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PAS-1* | 5-450 | DC-0.05 | 3.5 | 4.0 | 3.5 | 4.7 | 20 | 30 | 65 | 50 | 45 | 35 | 35 | 25 | 0.1 | 0.1 | 0.5 | 1.2 | 4-10 | A01 | cf | 33.95 |
| PAS-2* | 10-1000 | DC-0.05 | 4.0 | 6.0 | 6.5 | 8.5 | 20 | 30 | 50 | 40 | 40 | 30 | 35 | 25 | 0.1 | 0.3 | 0.5 | 1.0 | 4-10 | A01 | cg | 47.95 |
| PAS-3* | 1-200 | DC-0.05 | 1.4 | 2.0 | 1.6 | 2.5 | 15 | 30 | 65 | 50 | 50 | 40 | 50 | 35 | 0.1 | 0.1 | 0.5 | 1.0 | 4-11 | A01 | cf | 34.95 |
| PAS-2000** | 100-2000 | DC-0.5 | 4.2 | 6.5 | 5.4 | 7.5 | 19✲ | 25 | 30 | 22 | — | — | 26 | 20 | 0.3 | 0.4 | 5.0 | 8.0 | 4-11 | A05 | ch | 24.95 |
| ❑ TFAS-1* | 2-400 | DC-0.05 | 1.4 | 2.0 | 1.6 | 3.0 | 20✣ | 25 | 65 | 45 | 45 | 33 | 35 | 25 | 0.1 | 0.1 | 1.0 | 2.0 | 4-12 | B02 | cm | 13.95 |
| ❑ TFAS-2** | 10-1000 | DC-0.5 | 3.7 | 4.5 | 5.0 | 8.0 | 17★ | 25 | 50 | 30 | 42 | 20 | 31 | 20 | 0.1 | 0.2 | 2.0 | 3.0 | 4-12 | B02 | cm | 17.95 |
| ❑ TFAS-860** | 500-1000 | DC-0.5 | — | — | 1.5 | 5.4 | 14 | 25 | 30 | (typ.) | | 20 | (min.) | | — | 0.3 | — | 4.0 | 4-13 | B02 | cm | 19.95 |
| ❑ GAS-1** | 5-450 | DC-0.05 | 3.3 | 4 | 3.5 | 5.0 | 20 | 25 | 60 | 48 | 45 | 35 | 35 | 25 | 0.10 | 0.1 | 1.0 | 1.5 | 4-10 | A05 | cf | 13.95 |
| ❑ GAS-2** | 10-1000 | DC-0.05 | 4.3 | 6 | 5.2 | 8.5 | 20 | 25 | 55 | 40 | 35 | 25 | 28 | 20 | 0.10 | 0.3 | 1.5 | 3.0 | 4-10 | A05 | cg | 15.95 |
| ❑ GAS-3** | 5-200 | DC-0.05 | 1.2 | 2 | 1.4 | 2.5 | 20 | 25 | 50 | 45 | 45 | 35 | 40 | 30 | 0.10 | 0.1 | 0.5 | 1.0 | 4-11 | A05 | cf | 14.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10$f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

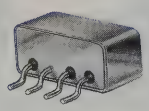
U = upper range ($f_U$/2 to $f_U$)

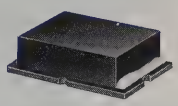


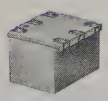

## NOTES:

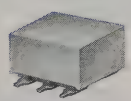
* Recommended for electronic attenuator
** Recommended for bi-phase modulator
❋ RAS-1 not available in tape & reel.
■ Denotes 75 Ohm model.
❑ Non-hermetic
✲ +15 dBm from 100-800 MHz
✣ +15 dBm from 2-10 MHz
★ +13 dBm from 10-500 MHz
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Control current, 30mA
2. Performance specifications apply for input power up to 10 dB below stated 1dB compression;
example: +5dBm in 2-10MHz range for TFAS-1, TFAS-1SM


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


TFAS-SM


SYAS


RAS


LRAS

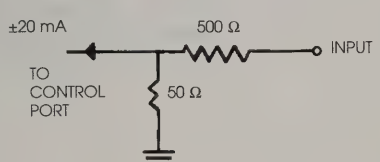
| MODEL NO. | FREQUENCY MHz IN $f_L$-$f_U$ | CON | INSERTION LOSS dB (±20 mA) Mid-Band m Typ. | Mid-Band m Max. | Total Range Typ. | Total Range Max. | MAX. INPUT POWER dBm (±20 mA) 1 dB comp. | no damage | IN-OUT ISOLATION dB (0 mA) L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | BI-PHASE $\overline{X}$ (±20 mA) Typ. Δ AMP (dB) m | Δ AMP (dB) Total Range | Phase(deg) Deviation From 180° m | Phase(deg) Deviation From 180° Total Range | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TFAS-1SM* | 2-400 | DC-0.05 | 1.4 | 2.0 | 1.6 | 3.0 | 20✤ | 25 | 65 | 45 | 45 | 33 | 35 | 25 | 0.1 | 0.1 | 1.0 | 2.0 | 4-12 | NNN150 | cm | 13.95 |
| TFAS-2SM** | 10-1000 | DC-0.5 | 3.7 | 4.5 | 5.0 | 8.0 | 17★ | 25 | 50 | 30 | 42 | 20 | 31 | 20 | 0.1 | 0.2 | 2.0 | 3.0 | 4-12 | NNN150 | cm | 17.95 |
| TFAS-860SM** | 500-1000 | DC-0.5 | — | — | 1.5 | 5.4 | 14 | 25 | 30 | (typ.) | | 20 | (min.) | | — | 0.3 | — | 4.0 | 4-13 | NNN150 | cm | 19.95 |
| SYAS-1* | 2-400 | DC-0.05 | 1.4 | 2.0 | 1.6 | 3.0 | 20✤ | 25 | 65 | 45 | 45 | 33 | 35 | 25 | 0.1 | 0.1 | 1.0 | 2.0 | 4-12 | TTT167 | ck | 9.95 |
| SYAS-2** | 10-1000 | DC-0.05 | 4.0 | 6.0 | 4.5 | 7.0 | 17★ | 25 | 59 | 40 | 42 | 28 | 28 | 20 | 0.1 | 0.3 | 2.0 | 3.0 | 4-12 | TTT167 | ck | 13.95 |
| SYAS-860** | 600-1000 | DC-0.5 | — | — | 2.7 | 5.7 | 14 | 25 | 25 | (typ.) | | 18 | (min.) | | — | 0.5 | — | 4.0 | 4-13 | TTT166 | ck | 15.95 |
| ✱ RAS-1** | 2-400 | DC-0.05 | 1.4 | 2.0 | 1.6 | 3.2 | 20✲ | 25 | 65 | 45 | 45 | 28 | 32 | 22 | 0.10 | 0.1 | 1.0 | 2.0 | - | TT146 | ge | 7.95 |
| ■ RAS-2-75** | 10-1000 | DC-0.05 | 4.1 | 6.0 | 4.5 | 7.5 | 20 | 25 | 58 | 40 | 42 | 28 | 39 | 20 | 0.15 | 0.3 | 1.5 | 3.0 | - | TT100 | cj | 9.95 |
| ■ LRAS-2-75** | 10-1000 | DC-0.05 | 4.1 | 6.0 | 4.5 | 7.5 | 20 | 25 | 58 | 40 | 42 | 28 | 39 | 20 | 0.15 | 0.3 | 1.5 | 3.0 | - | QQQ130 | cj | 9.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10$f_L$ to $f_U$/2)
m = mid band (2$f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

suggested control port biasing configuration




## pin and coaxial connections

see case style outline drawings for pin locations

| PORT | cf | cg | ch | cj | ck | cm | ge |
|---|---|---|---|---|---|---|---|
| INPUT | 1 | 1 | 1 | 4 | 1 | 1 | 4 |
| OUTPUT | 8 | 8 | 8 | 1 | 2 | 4 | 1 |
| CONTROL | 3,4 ^ | 3,4 ^ | 3 | 5 | 3 | 2 | 5 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,3,6 | 4,5,6 | 3 | 2,3,6 |
| CASE GND | 2 | 2,5,6,7 | 2,5,6,7 | — | — | 3 | — |
| NOT USED | — | — | 4 | — | — | — | — |

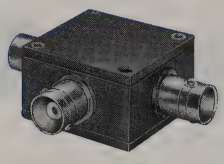
^ Pins must be connected together externally.

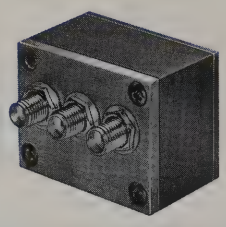
**NSN GUIDE**

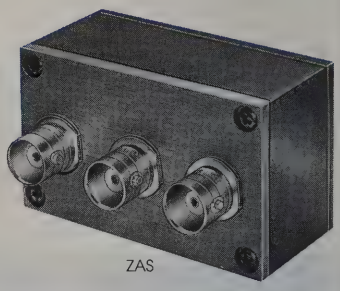
| MCL NO. | NSN |
|---|---|
| PAS-1 | 5985-01-282-2105 |
| PAS-2 | 5985-01-192-0100 |
| PAS-3 | 5895-01-067-3035 |

In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.
Available Tape & Reel

## BI-PHASE 1 MHz to 2 GHz


ZFAS

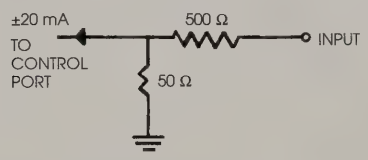

ZMAS

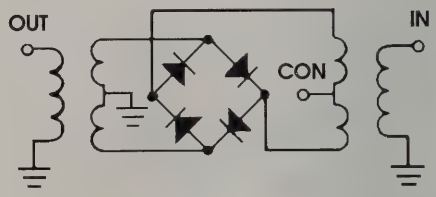

ZAS

| MODEL NO. | FREQUENCY MHz IN $f_L$-$f_U$ | CON | INSERTION LOSS dB (±20 mA) Mid-Band m Typ. | Mid-Band m Max. | Total Range Typ. | Total Range Max. | MAX. INPUT POWER dBm (±20 mA) 1 dB comp. | no damage | IN-OUT ISOLATION dB (0 mA) L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | BI-PHASE $\overline{X}$ (±20 mA) Typ. Δ AMP (dB) m | Δ AMP (dB) Total Range | Phase(deg) Deviation From 180° m | Phase(deg) Deviation From 180° Total Range | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZMAS-1* | 5-450 | DC-0.05 | 3.5 | 4 | 3.5 | 4.7 | 20 | 30 | 65 | 50 | 55 | 45 | 35 | 25 | 0.10 | 0.1 | 0.5 | 1.2 | 4-10 | M21 | cp | 66.95 |
| ZMAS-3* | 1-200 | DC-0.05 | 1.4 | 2 | 1.6 | 2.5 | 15 | 30 | 65 | 50 | 50 | 40 | 50 | 35 | 0.10 | 0.1 | 0.5 | 1.0 | 4-11 | M21 | cp | 67.95 |
| ZAS-1* | 5-450 | DC-0.05 | 3.5 | 4 | 3.5 | 4.7 | 20 | 30 | 65 | 50 | 55 | 45 | 35 | 25 | 0.10 | 0.1 | 0.5 | 1.2 | 4-10 | M22 | cp | 59.95 |
| ZAS-3* | 1-200 | DC-0.05 | 1.4 | 2 | 1.6 | 2.5 | 15 | 30 | 65 | 50 | 50 | 40 | 50 | 35 | 0.10 | 0.1 | 0.5 | 1.0 | 4-11 | M22 | cp | 59.95 |
| △ ZFAS-2000** | 100-2000 | DC-0.5 | 4.2 | 6.5 | 5.4 | 7.5 | 19✲ | 25 | 30 | 22 | — | — | 26 | 20 | 0.3 | 0.4 | 5.0 | 8.0 | 4-11 | K18 | cn | 64.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10$f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)
m = mid band (2$f_L$ to $f_U$/2)

suggested control port biasing configuration




**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| ZAS-3B | 5985-01-267-2832 |
| ZMAS-1 | 5985-01-140-4291 |

NOTES:
- * Recommended for electronic attenuator
- ** Recommended for bi-phase modulator
- △ Available only with SMA connectors.
- ✲ +15 dBm from 100-800 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings: 1a. Control current, 30mA
- 2. Performance specifications apply for input power up to 10 dB below stated 1dB compression.

coaxial connections
see case style outline drawings

| PORT | cn | cp |
|---|---|---|
| INPUT | 2 | 3 |
| OUTPUT | 1 | 1 |
| CONTROL | 3 | 2 |
| GND EXT. | — | — |
| CASE GND | — | — |
| NOT USED | — | — |



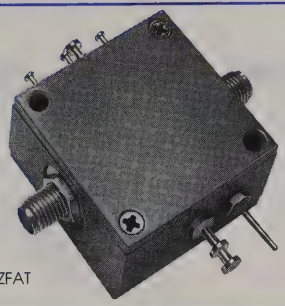
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

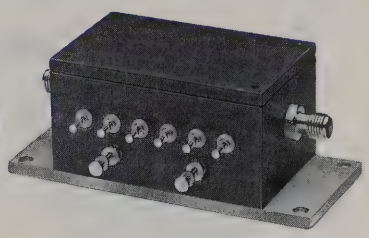
# DIGITAL STEP ATTENUATORS

50Ω Precision

## TTL CONTROL, PIN DIODE 10 MHz to 1 GHz

TOAT


ZFAT


ZSAT

| MODEL NO. | FREQ. MHz $f_L$ | FREQ. MHz $f_U$ | PRIMARY ATTENUATION STEPS (dB) @TTL CONTROL PORT #1 | #2 | #3 | ATTENUATION (dB) LOGIC STATE* (1,1,1)** Nom. | (0,0,0) Max. | VSWR L | M | U | CAPD DATA (see RF/IF Designer Handbook) Page | Case Style Note B | CONNECTION | Price $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOAT-R512 | 10 | 1000 | 0.5±0.18 | 1±0.25 | 2±0.25 | 3.5 | 4.0 | 1.6 | 1.4 | 1.5 | 5-6 | QQ96 | cq | 59.95 |
| TOAT-124 | 10 | 1000 | 1±0.25 | 2±0.25 | 4±0.3 | 7.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-7 | QQ96 | cq | 59.95 |
| TOAT-3610 | 10 | 1000 | 3±0.3 | 6±0.4 | 10±0.4 | 19.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-8 | QQ96 | cq | 59.95 |
| TOAT-4816 | 10 | 1000 | 4±0.4 | 8±0.4 | 16±0.5 | 28.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-9 | QQ96 | cq | 59.95 |
| TOAT-51020 | 10 | 1000 | 5±0.4 | 10±0.4 | 20±0.5 | 35.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-10 | QQ96 | cq | 59.95 |
| ZFAT-R512 | 10 | 1000 | 0.5±0.18 | 1±0.25 | 2±0.25 | 3.5 | 4.0 | 1.6 | 1.4 | 1.5 | 5-6 | SSS173 | - | 89.95 |
| ZFAT-124 | 10 | 1000 | 1±0.25 | 2±0.25 | 4±0.3 | 7.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-7 | SSS173 | - | 89.95 |
| ZFAT-3610 | 10 | 1000 | 3±0.3 | 6±0.4 | 10±0.4 | 19.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-8 | SSS173 | - | 89.95 |
| ZFAT-4816 | 10 | 1000 | 4±0.4 | 8±0.4 | 16±0.5 | 28.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-9 | SSS173 | - | 89.95 |
| ZFAT-51020 | 10 | 1000 | 5±0.4 | 10±0.4 | 20±0.5 | 35.0 | 4.0 | 1.6 | 1.4 | 1.5 | 5-10 | SSS173 | - | 89.95 |
| | | | SIX CONTROL PORTS | | | | | | | | | | | |
| ZSAT-31R5 | 10 | 1000 | (1) 0.5±0.18 (4) 4±0.3 | (2) 1±0.25 (5) 8±0.4 | (3) 2±0.25 (6)16±0.5 | 31.5 | 7.0 | 1.7 | 1.5 | 1.6 | — | AR214 | - | 119.00 |

L = 10 to 100 MHz M = 100 to 500 MHz U = 500 to 1000 MHz

## features

- wide frequency band, 10-1000 MHz
- excellent step accuracy, 0.2 dB typ.
- excellent VSWR, 1.3 typ.
- low DC current, 6 mA typ.
- operates over -55° to 100 °C
- small case, 0.6" dia., TO-8

## Additional Specifications

DC Voltage +5V
DC current 10mA max.
Switching Time (50% TTL to within specified accuracy of the next-selected attenuation step, and to within 0.1 dB of steady-state Thru-Loss) 10 µs typ., 15µs max.
TTL input High Threshold 2V min.
TTL input Low Threshold 0.8V max.
TTL Toggle Rate: 50 kHz typ.
1dB compression: 0 dBm (10-100MHz)
+10dBm (100-1000MHz)
For ZSAT-31R5:
1dB compression: +10 dBm (10-100 MHz)
+15 dBm (100-1000 MHz)

## Logic function:

TTL High activates associated in-line attenuation
TTL Low bypasses this attenuation

### NSN GUIDE

| MCL NO. | NSN |
|---|---|
| TOAT-124 | 5985-01-416-9021 |
| TOAT-51020 | 5985-01-416-9020 |

NOTES:
* For ZSAT-31R5: Total attenuation (1,1,1,1,1,1)
Thru-Loss (0,0,0,0,0,0)
** Total attenuation above thru-loss.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. Input power, 15 dBm
1b. DC voltage, 5.5 Volts
1c. TTL, 5.5 Volts
1d. Storage temperature -55°C to +125°C for TOAT models.
2. Step accuracy is specified for basic steps. For combination of steps accuracy is additive.
3. Thru-loss is minimum insertion loss with all attenuation elements bypassed (All TTL controls state are Low).
4. For optimum operation of TOAT models, ensure the device case is properly connected to the ground plane (of PC board).

## pin connections

see case style outline drawing

| PORT | cq |
|---|---|
| RF IN | 4 |
| RF OUT | 11 |
| TTL CONTROL #1 | 2 |
| TTL CONTROL #2 | 3 |
| TTL CONTROL #3 | 1 |
| +5V DC | 12 |
| CASE GND | 5,6,7,8,9,10 |

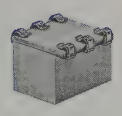
CAPD now available! computer-automated performance data

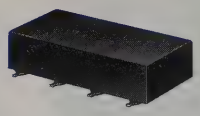
## In Stock... Immediate Delivery

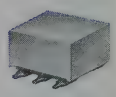
For Custom Versions Of Standard Models Consult Our Applications Dept.

# DIRECTIONAL COUPLERS 50 & 75Ω Surface Mount,

## 6 to 20 dB COUPLING 5 MHz to 1200 MHz


JDC


SCDC


LRDC

| | MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | COUPLING dB Nom. | Flatness | MAINLINE LOSS dB L Typ. | L Max. | M✪ Typ. | M✪ Max. | U Typ. | U Max. | DIRECTIVITY dB L Typ. | L Min. | M✪ Typ. | M✪ Min. | U Typ. | U Min. | VSWR (:1) Typ. | POWER INPUT, W L Max. | MU Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | JDC-6-1 | 5-400 | 6.5±0.5 | ±0.5 | 1.6 | 2.0 | 1.7 | 2.4 | 2.0 | 2.4 | 35 | 30 | 25 | 20 | 20 | 15 | 1.25 | .5 | .5 | -- | BH292 | hz | 14.95 |
| NEW | JDC-10-2 | 5-750 | 10.0±0.5 | ±0.6 | 1.0 | 1.5 | 1.0 | 1.5 | 1.0 | 1.5 | 20 | 15 | 20 | 17 | 20 | 16 | 1.13 | 1 | 1 | -- | BH292 | hz | 14.95 |
| NEW | JDC-20-2 | 400-900 | 20.5±1.0 | ±1.0 | | | 0.2 | 0.6 | | | | | 19 | 13 | | | 1.15 | 2 | 2 | -- | BH292 | hz | 14.95 |
| NEW ■ | JDC20-1W-75 | 50-750 | 19.5±0.5 | ±0.5 | 0.5 | 0.9 | 0.5 | 0.7 | 0.5 | 0.9 | 25 | 18 | 23 | 15 | 20 | 15 | 1.2 | .5 | .5 | -- | BH292 | hz | 14.95 |
| | SCDC-11-2 | 500-1100 | 11.3±0.5 | ±0.6 | | | 1.1 | 1.8 | | | | | 20 | 10 | | | 1.4 | 2 | 2 | 7-18 | YY161 | cx | 11.95 |
| | SCDC-25-2 | 500-1100 | 25.5±0.75 | ±0.8 | | | 0.5 | 1.0 | | | | | 22 | 10 | | | 1.4 | 2 | 2 | 7-18 | YY161 | cx | 13.95 |
| | LRDC-10-1 | 5-500 | 10.7±0.5 | ±0.5 | 0.9 | 1.4 | 0.9 | 1.4 | 1.2 | 1.9 | 31 | 25 | 30 | 20 | 25 | 16 | 1.2 | 1 | 1 | — | QQQ130 | cz | 15.95 |
| | LRDC-20-2 | 300-1100 | 20.5±1.0 | ±1.3 | | | 0.25 | 0.6 | | | | | 22 | 10 | | | 1.2 | 2 | 2 | 7-20 | QQQ130 | cz | 15.95 |
| ■ | LRDC-10-1-75 | 5-600 | 10.7±0.5 | ±0.5 | 1.1 | 1.5 | 1.0 | 1.4 | 1.2 | 1.8 | 19 | 15 | 21 | 17 | 21 | 16 | 1.3 | 1 | 1 | — | QQQ130 | cz | 11.95 |
| ■ | LRDC-10-2-75 | 30-1000 | 10.0±0.5 | ±0.6 | 1.0 | 1.5 | 1.1 | 1.5 | 1.3 | 1.8 | 21 | 17 | 22 | 17 | 19 | 15 | 1.3 | 1 | 1 | — | QQQ130 | cz | 13.95 |
| ■ | LRDC-10-2W-75 | 30-1200 | 10.0±0.5 | ±0.8 | 1.0 | 1.5 | 1.1 | 1.6 | 1.3 | 2.0 | 21 | 17 | 22 | 17 | 18 | 15 | 1.3 | 1 | 1 | — | QQQ130 | cz | 15.95 |
| ■ | LRDC-12-1-75 | 5-600 | 12.2±0.5 | ±0.6 | 0.4 | 0.8 | 0.5 | 1.0 | 0.8 | 1.5 | 20 | 17 | 21 | 18 | 20 | 12 | 1.3 | 1 | 1 | — | QQQ130 | cz | 11.95 |

L = low range ($f_L$ to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

NOTES:
- ❑ Non-hermetic
- * L = 30-100 MHz, M = 100-200 MHz, Operating Temperature +50° C Max.
- ** L = 40-100 MHz, M = 100-200 MHz
- ✦ Bi-directional
- △ Available only with SMA connectors.
- ■ Denotes 75 ohm models.
- ✪ When only specification for M range given, specification applies to entire frequency range.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 2. Mainline Loss includes theorical power loss at coupled port.
- 3. For PDC models, external heat sinking is recommended to reduce case temperature.

### pin and coaxial connections

See case style outline drawing for pin locations

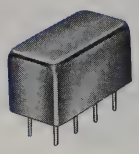
| PORT | cu | cx | cz | gh | de | gj | hz |
|---|---|---|---|---|---|---|---|
| INPUT | 1 | 1 | 6 | 1 | S | 2 | 1 |
| OUTPUT | 4 | 2 | 1 | 2 | 1 | 3 | 6 |
| COUPLED (forward) | 3 | 5 | 4 | 5 | 3 | 1 | 3 |
| COUPLED (reverse) | — | — | — | — | 2 | S | -- |
| NOT USED | 6 | 3,6 | 3** | — | — | — | 4 |
| CASE GND | 2,5,7,8 | -- | -- | 3,4,6,7,8 | — | — | -- |
| GND | -- | 4,7,8 | 2,5 | -- | — | — | 2,5 |

**isolate

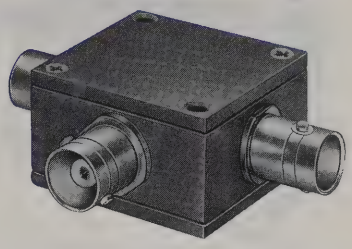


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 20 dB COUPLING up to 25W 30 to 970 MHz



PDC



ZFDC

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | COUPLING dB Nom. | Flatness | MAINLINE LOSS dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | DIRECTIVITY dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | VSWR (:1) Typ. | POWER INPUT, W L Max. | MU Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PDC20-400HP** | 40-400 | 21.5±0.5 | ±0.6 | 0.1 | 0.3 | 0.2 | 0.4 | 0.2 | 0.5 | 30 | 20 | 30 | 20 | 27 | 18 | 1.1 | 10 | 10 | — | A01 | gh | 49.95 |
| PDC20-900HP | 800-900 | 20.2±0.6 | ±0.5 | | | 0.25 | 0.5 | | | | | 24 | 20 | | | 1.1 | 5 | 5 | — | A01 | cu | 39.95 |
| PDC20-970HP | 860-970 | 20.2±0.6 | ±0.5 | | | 0.25 | 0.5 | | | | | 24 | 20 | | | 1.1 | 5 | 5 | — | A01 | cu | 39.95 |
| ✦ ZFDC-20-1H* | 30-400 | 20.5±0.5 | ±0.4 | 0.15 | 0.4 | 0.15 | 0.4 | 0.3 | 0.4 | 30 | 25 | 30 | 25 | 30 | 23 | 1.2 | 25 | 25 | 7-13 | J17 | de | 58.95 |
| △✦ ZFBDC20-900HP | 800-900 | 20.7±0.6 | ±0.6 | | | 0.1 | 0.4 | | | | | 28 | 20 | | | 1.1 | 10 | 10 | — | J17 | gj | 79.95 |
| △✦ ZFBDC20-970HP | 860-970 | 20.4±0.6 | ±0.6 | | | 0.1 | 0.4 | | | | | 28 | 20 | | | 1.1 | 10 | 10 | — | J17 | gj | 79.95 |

L = low range ($f_L$ to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

## features

- high power operation
- very low insertion loss
- excellent directivity
- excellent VSWR, 1.1:1 typical
- wide bandwidth, 30-400 MHz model ZFDC-20-1H and 40-400 MHz model PDC20-400HP
- cellular application, models PDC-HP ZFDC-HP

**NSN GUIDE** (see the following pages for model specifications)

| MCL NO. | NSN | MIL-C 15370/18* |
|---|---|---|
| PDC-10-1 | 5985-01-178-4406 | 002 |
| PDC-10-1-75 | 5985-01-294-3796 | |
| PDC-10-2 | | 008 |
| PDC-10-5 | 5895-01-389-9497 | |
| PDC-10-21 | 5985-01-130-0177 | 003 |
| PDC-10-22 | 5985-01-190-7738 | |
| PDC-10-54 | 5895-01-394-6080 | |
| PDC-15-6 | 5985-01-147-0160 | 009 |
| PDC-20-3 | 5985-01-076-8477 | 001 |
| TDC-10-1 | 5905-01-226-3428 | |
| ZDC-10-1B | 5985-01-391-5675 | |
| ZDC-10-1(BNC) | 5985-01-125 3467 | |
| ZDC-20-1 | 5985-01-178-4405 | |
| ZDC-20-3(BNC) | 5985-01-096-5007 | |
| ZDC-20-3B | 5985-01-264-9105 | |
| ZEDC-10-2 | 5985-01-251-2669 | |
| ZEDC-15-2B | 5985-01-337-9981 | |
| ZFDC-10-1 | 5985-01-230-6676 | |

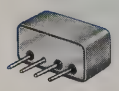
**NSN GUIDE** (see the following pages for model specifications)

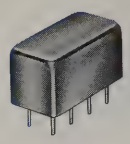
| MCL NO. | NSN |
|---|---|
| ZFDC-10-1(SMA) | 5985-01-179-5122 |
| ZFDC-10-1B | 5985-01-135-9780 |
| ZFDC-10-2 | 5985-01-208-5694 |
| ZFDC-10-21 | 5985-01-253-0600 |
| ZFDC-10-5(SMA) | 5985-01-417-0065 |
| ZFDC-10-6B | 5985-01-314-4176 |
| ZFDC-15-5 | 5985-01-298 0144 |
| ZFDC-15-6 | 5985-01-330-6792 |
| ZFDC-20-2 | 5985-01-230-6676 |
| ZFDC-20-3(BNC) | 5985-01-146-0478 |
| ZFDC-20-3(TNC) | 5985-01-226-7882 |
| ZFDC-20-3(SMA) | 6130-01-383-9709 |
| ZFDC-20 4 | 5985-01-266-9992 |
| ZFDC-20-5(BNC) | 5985-01-097-2192 |
| ZMDC-10-1 | 4935-01-227-6945 |
| ZMDC-10-1B | 4935-01-227-6945 |
| ZMDC-20-3 | 5985-01-193-8515 |

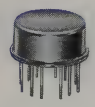
* units are not QPL listed.

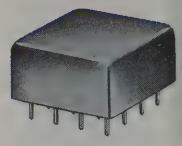
# DIRECTIONAL COUPLERS 50 & 75Ω

## 6 to 30 dB COUPLING 5 kHz to 2000 MHz


TDC


PDC


TODC


P4DC
PDC-20A-5

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | COUPLING dB Nom. | Flatness | MAINLINE LOSS dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | DIRECTIVITY dB L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | VSWR (:1) Typ. | POWER INPUT, W L Max. | MU Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TDC-6-1 | 10-400 | 6.3±0.4 | ±0.4 | 2.0 | 2.4 | 2.0 | 2.4 | 2.0 | 2.5 | 36 | 30 | 30 | 25 | 20 | 15 | 1.5 | 1 | 2 | 7-8 | B02 | cw | 23.95 |
| TDC-10-1 | 1-400 | 10.0±0.5 | ±0.5 | 1.2 | 1.5 | 1.0 | 1.3 | 1.2 | 1.5 | 35 | 25 | 30 | 20 | 20 | 15 | 1.5 | 1 | 2 | 7-8 | B02 | cw | 17.95 |
| TDC-10-2 | 5-1000 | 11±0.5 | ±0.6 | 1.4 | 1.8 | 1.5 | 1.8 | 1.6 | 2.0 | 50 | 35 | 25 | 20 | 20 | 15 | 1.5 | 0.5 | 0.5 | 7-8 | B02 | cw | 25.95 |
| PDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 0.85 | 1.3 | 0.65 | 1.0 | 0.85 | 1.3 | 32 | 25 | 32 | 25 | 22 | 15 | 1.2 | 1.5 | 3 | 7-9 | A01 | cu | 13.45 |
| ✦ PDC-10-1BD | 1-400 | 11.5±0.5 | ±0.5 | 0.6 | 0.9 | 0.8 | 1.1 | 0.9 | 1.3 | 55 | 35 | 35 | 20 | 22 | 15 | 1.2 | 2.0 | 4 | 7-19 | A01 | cu | 11.45 |
| ✣ PDC-10-2 | 250-1000 | 10.5±0.5 | ±0.6 | 1.4 | 1.6 | — | — | 1.6 | 2.0 | 30 | 23 | — | — | 25 | 15 | 1.5 | — | 5 | 7-9 | A01 | cu | 34.45 |
| PDC-10-5 | 1-2000 | 10.5±0.5 | ±1.0 | 1.2 | 1.9 | 1.3 | 1.9 | 2.0 | 2.5 | 38 | 25 | 30 | 18 | 22 | 18 | 1.3 | 0.5 | 0.5 | 7-9 | A01 | cu | 40.95 |
| PDC-10-6 | 0.005-20 | 11±0.5 | ±0.5 | 0.4 | 1.2 | 0.4 | 0.8 | 0.4 | 1.0 | 40 | 30 | 40 | 30 | 35 | 25 | 1.3 | 1.5 | 3 | 7-10 | A01 | cu | 23.95 |
| PDC-10-21** | 1-1000 | 11±0.5 | ±0.5 | 1.2 | 1.7 | 1.2 | 1.7 | 1.6 | 2 | 40 | 30 | 25 | 20 | 25 | 20 | 1.3 | 1 | 2 | 7-10 | A01 | cu | 32.95 |
| PDC-10-22 | 5-750 | 11±0.5 | ±0.5 | 1.1 | 1.6 | 1.2 | 1.7 | 1.6 | 1.9 | 35 | 30 | 25 | 20 | 25 | 20 | 1.25 | 1 | 2 | 7-10 | A01 | cu | 23.95 |
| PDC-10-54 | 10-1500 | 10.5±0.5 | ±0.7 | 1.2 | 1.8 | 1.3 | 1.9 | 1.6 | 2.3 | 35 | 25 | 28 | 23 | 28 | 23 | 1.3 | 0.5 | 0.5 | 7-11 | A01 | cu | 35.95 |
| PDC-15-6 | 0.01-35 | 15±0.5 | ±0.5 | 0.3 | 0.6 | 0.2 | 0.4 | 0.3 | 0.6 | 38 | 30 | 35 | 25 | 28 | 20 | 1.15 | 2 | 4 | 7-11 | A01 | cu | 23.95 |
| PDC-15-21 | 1-500 | 14.7±0.5 | ±0.6 | 0.7 | 1.1 | 0.7 | 1.1 | 0.8 | 1.2 | 35 | 30 | 35 | 30 | 30 | 23 | 1.4 | 1 | 2 | 7-11 | A01 | cu | 23.95 |
| PDC-20-1* | 25-400 | 21±0.75 | ±0.5 | 0.2 | 0.25 | 0.3 | 0.35 | 0.35 | 0.5 | 25 | 20 | 35 | 25 | 25 | 20 | 1.25 | 3 | 5 | 7-12 | A01 | cu | 23.95 |
| ✦ PDC-20-1BD | 0.5-200 | 19.2±0.5 | ±0.5 | 0.3 | 0.5 | 0.3 | 0.5 | 0.4 | 0.6 | 40 | 30 | 35 | 20 | 22 | 18 | 1.1 | 3 | 5 | 7-19 | A01 | cv | 16.95 |
| PDC-20-1W | 10-700 | 19.2±0.5 | ±0.5 | 0.25 | 0.5 | 0.4 | 0.7 | 0.7 | 1.1 | 34 | 30 | 27 | 23 | 23 | 20 | 1.4 | 1 | 2 | 7-12 | A01 | cu | 23.95 |
| PDC-20-3 | 0.2-250 | 19.5±0.5 | ±0.5 | 0.35 | 0.6 | 0.25 | 0.5 | 0.35 | 0.6 | 36 | 30 | 33 | 25 | 25 | 20 | 1.2 | 1.5 | 4 | 7-12 | A01 | cu | 15.95 |
| ✦ PDC-20-3BD | 0.2-250 | 19.5±0.5 | ±0.5 | 0.3 | 0.6 | 0.25 | 0.5 | 0.35 | 0.6 | 47 | 25 | 40 | 25 | 30 | 20 | 1.1 | 1.5 | 4 | 7-19 | A01 | cv | 17.95 |
| PDC-20A-5 | 0.1-2000 | 20.0±0.5 | ±1.0 | 0.6 | 1.5 | 0.6 | 1.5 | 1.9 | 2.9 | 34 | 20 | 25 | 15 | 20 | 10 | 1.5 | 0.5 | 2 | 7-15 | C145 | cy | 44.95 |
| ■ PDC-10-1-75 | 1-250 | 10.5±0.5 | ±0.75 | 1.1 | 1.5 | 1.1 | 1.5 | 1.1 | 1.5 | 30 | 20 | 30 | 20 | 30 | 20 | 2.0 | 2 | 4 | 7-16 | A01 | cu | 14.95 |
| ■ PDC-10-6-75 | 0.2-100 | 10.0±0.5 | ±0.2 | 1.2 | 1.6 | 0.9 | 1.2 | 0.9 | 1.3 | 50 | 30 | 40 | 25 | 37 | 25 | 1.5 | 1 | 2 | 7-16 | A01 | cu | 23.95 |
| ■ PDC-15-6-75 | 0.02-35 | 14.5±0.5 | ±0.5 | 0.3 | 0.7 | 0.3 | 0.7 | 0.3 | 0.7 | 35 | 20 | 35 | 20 | 35 | 20 | 1.3 | 1.5 | 4 | 7-16 | A01 | cu | 25.95 |
| ■ PDC-20-3-75 | 1-150 | 19.5±0.5 | ±0.75 | 0.35 | 0.8 | 0.35 | 0.8 | 0.35 | 0.8 | 25 | 20 | 25 | 20 | 25 | 20 | 2.0 | 2 | 4 | 7-17 | A01 | cu | 14.95 |
| ■ PDC-20-6-75 | 0.05-40 | 20.4±0.3 | ±0.25 | 0.1 | 0.25 | 0.1 | 0.2 | 0.1 | 0.3 | 45 | 35 | 35 | 20 | 25 | 18 | 1.2 | 1.5 | 3 | 7-17 | A01 | cu | 23.95 |
| TODC-10-1 | 10-400 | 11.3±0.5 | ±0.5 | 1.2 | 1.5 | 1.0 | 1.3 | 1.2 | 1.5 | 35 | 25 | 30 | 20 | 25 | 20 | 1.5 | 0.5 | 1 | 7-13 | QQ96 | ct | 17.95 |
| ✷ P4DC-30A-2 | 5-1000 | 30.5±0.5 | ±1 | 0.7 | 1.2 | 0.7 | 1.2 | 0.8 | 1.5 | 30 | 15 | 32 | 20 | 20 | 10 | 1.15 | 1 | 2 | 7-22 | C07 | da | 34.95 |

L = low range ($f_L$ to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

- NSN Guide - see previous page

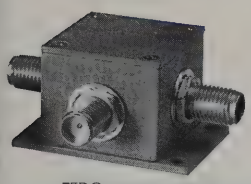
NOTES:

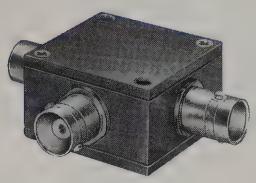
* L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
** Upper range coupling ±0.75 dB
*** Above 1000 MHz, coupling flatness ±1 dB.
✦ Bi-directional
✣ $L = f_L$-$2f_L$
✷ 4-coupled ports, isolation between coupled ports, 25 dB minimum.
✪ When only specification for M range given, specification applies to entire frequency range.
△ Available only with SMA connectors

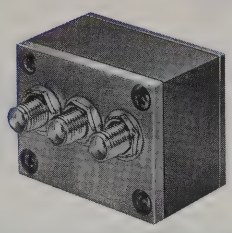
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
2. Mainline Loss includes theorical power loss at coupled port.

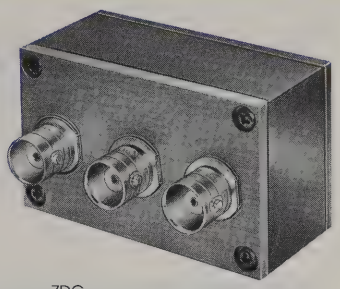


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010


ZEDC


ZFDC


ZMDC


ZDC

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | COUPLING dB Nom. | Flatness | MAINLINE LOSS dB L Typ. | L Max. | M◎ Typ. | M◎ Max. | U Typ. | U Max. | DIRECTIVITY dB L Typ. | L Min. | M◎ Typ. | M◎ Min. | U Typ. | U Min. | VSWR (:1) Typ. | POWER INPUT, W L Max. | MU Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZEDC-10-2B | 1-1000 | 11±0.5 | ±0.75 | 1.3 | 1.8 | 1.5 | 1.8 | 1.5 | 1.8 | 35 | 30 | 30 | 20 | 18 | 13 | 1.3 | 1.5 | 3 | 7-15 | V37 | db | 64.95 |
| ZEDC-15-2B | 1-1000 | 15±0.5 | ±0.5 | 0.5 | 1.4 | 0.8 | 1.2 | 1.0 | 1.4 | 35 | 30 | 30 | 25 | 25 | 15 | 1.15 | 1.5 | 3 | 7-15 | V37 | db | 64.95 |
| ZFDC-10-1 | 1-500 | 10.5±0.25 | ±0.6 | 1.0 | 1.3 | 0.8 | 1.1 | 1.0 | 1.3 | 32 | 25 | 33 | 25 | 22 | 15 | 1.2 | 1.5 | 3 | 7-9 | K18 | db | 44.95 |
| ZFDC-10-2 | 10-1000 | 10.75±0.5 | ±0.5 | 1.5 | 2.0 | 1.2 | 1.8 | 1.5 | 2.0 | 35 | 28 | 30 | 25 | 27 | 20 | 1.5 | 1.5 | 3 | 7-14 | K18 | db | 51.95 |
| ZFDC-10-5 | 1-2000 | 10.8±0.5 | ±1.0 | 1.2 | 1.9 | 1.2 | 1.8 | 1.8 | 2.5 | 38 | 25 | 30 | 18 | 22 | 18 | 1.3 | 0.5 | 0.5 | 7-9 | K18 | db | 84.95 |
| ZFDC-10-6 | 0.005-20 | 11±0.5 | ±0.5 | 0.4 | 1.2 | 0.4 | 0.8 | 0.4 | 1.0 | 40 | 30 | 40 | 30 | 35 | 25 | 1.3 | 1.5 | 3 | 7-10 | K18 | db | 52.95 |
| ZFDC-10-21** | 1-1000 | 11±0.5 | ±0.5 | 1.2 | 1.7 | 1.2 | 1.7 | 1.6 | 2.0 | 40 | 30 | 25 | 20 | 25 | 20 | 1.2 | 1 | 2 | 7-10 | K18 | db | 54.95 |
| ■ ZFDC-10-1-75 | 1-400 | 10.5±0.5 | ±0.5 | 1.0 | 1.4 | 1.1 | 1.5 | 1.1 | 1.6 | 46 | 30 | 44 | 28 | 34 | 20 | 1.3 | 2 | 4 | 7-21 | K18 | db | 45.95 |
| ■ ZFDC-10-21-75 | 10-750 | 11±0.5 | ±0.75 | 1.5 | 1.8 | 1.5 | 1.9 | 1.7 | 2.1 | 36 | 30 | 30 | 20 | 26 | 20 | 1.4 | 1 | 2 | 7-21 | K18 | db | 54.95 |
| ZFDC-10-22 | 1-750 | 11±0.5 | ±0.5 | 1.1 | 1.9 | 1.2 | 1.7 | 1.4 | 1.9 | 35 | 30 | 25 | 20 | 25 | 20 | 1.25 | 1 | 2 | 7-10 | K18 | db | 49.95 |
| ZFDC-15-5 | 1-2000 | 15.5±0.5 | ±1.0 | 1.2 | 1.8 | 1.2 | 1.8 | 1.3 | 2.3 | 30 | 20 | 25 | 20 | 18 | 11 | 1.3 | 0.5 | 2 | 7-14 | K18 | dc | 71.95 |
| ZFDC-15-6 | 0.03-35 | 15±0.5 | ±0.5 | 0.3 | 0.6 | 0.2 | 0.4 | 0.3 | 0.6 | 38 | 30 | 35 | 25 | 28 | 20 | 1.15 | 2 | 4 | 7-11 | K18 | db | 49.95 |
| ■ ZFDC-15-6-75 | 0.02-35 | 14.5±0.5 | ±0.5 | 0.3 | 0.7 | 0.3 | 0.7 | 0.3 | 0.7 | 35 | 20 | 35 | 20 | 35 | 20 | 1.3 | 1.5 | 4 | 7-16 | K18 | db | 49.95 |
| ZFDC-20-3 | 0.2-250 | 19.5±0.5 | ±0.25 | 0.35 | 0.6 | 0.25 | 0.5 | 0.35 | 0.6 | 36 | 25 | 33 | 25 | 25 | 20 | 1.2 | 1.5 | 4 | 7-12 | K18 | db | 44.95 |
| ■ ZFDC-20-3-75 | 10-250 | 19.3±0.5 | ±0.3 | 0.25 | 0.4 | 0.3 | 0.5 | 0.4 | 0.6 | 29 | 25 | 29 | 25 | 28 | 24 | 1.2 | 1 | 2 | 7-21 | K18 | db | 49.95 |
| ZFDC-20-4 | 1-1000 | 19.5±0.5 | ±0.5 | 1.2 | 1.5 | 0.6 | 0.8 | 1.2 | 1.5 | 36 | 28 | 27 | 20 | 23 | 18 | 1.1 | .5 | 2 | 7-14 | K18 | dc | 64.95 |
| △ ZFDC-20-4L | 10-1000 | 20.2±0.5 | ±0.5 | 0.2 | 0.5 | 0.3 | 0.7 | 0.7 | 1.2 | 40 | 20 | 30 | 16 | 20 | 14 | 1.1:1 | 1 | 1 | — | K18 | db | 64.95 |
| ZFDC-20-5*** | 0.1-2000 | 19.5±0.5 | ±0.5 | 0.3 | 1 | 0.7 | 1.4 | 1.5 | 2.3 | 30 | 20 | 27 | 20 | 22 | 10 | 1.2 | .5 | 2 | 7-20 | K18 | dc | 84.95 |
| ■ ZFDC-3375 | 0.2-200 | 30.5±0.5 | ±0.6 | 0.5 | 0.8 | 0.6 | 0.9 | 0.7 | 1.0 | 30 | 25 | 25 | 20 | 19 | 15 | 1.6 | .5 | 2 | 7-12 | K18 | db | 45.95 |
| ZMDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 0.85 | 1.3 | 0.65 | 1.0 | 0.85 | 1.3 | 32 | 25 | 32 | 25 | 22 | 15 | 1.2 | 1.5 | 3 | 7-9 | M21 | dd | 49.95 |
| ❖ ZMDC-10-2 | 250-1000 | 10.5±0.5 | ±0.5 | 1.1 | 1.4 | — | — | 1.6 | 1.9 | 40 | 30 | — | — | 20 | 15 | 1.5 | — | 5 | 7-9 | M21 | dd | 59.95 |
| ZMDC-15-6 | 0.1-35 | 15±0.5 | ±0.5 | 0.4 | 0.6 | 0.2 | 0.4 | 0.4 | 0.6 | 38 | 30 | 35 | 25 | 28 | 20 | 1.15 | 2 | 4 | 7-11 | M21 | dd | 59.95 |
| ZMDC-20-1* | 25-400 | 21±0.75 | ±0.5 | 0.2 | 0.25 | 0.3 | 0.35 | 0.35 | 0.5 | 25 | 20 | 35 | 25 | 25 | 20 | 1.25 | 3 | 5 | 7-12 | M21 | dd | 59.95 |
| ZMDC-20-3 | 0.2-250 | 19.5±0.5 | ±0.5 | 0.35 | 0.5 | 0.35 | 0.5 | 0.35 | 0.6 | 36 | 30 | 33 | 25 | 25 | 20 | 1.2 | 1.5 | 4 | 7-12 | M21 | dd | 49.95 |
| ZMDC-30-1 | 0.1-250 | 30±0.5 | ±0.5 | 0.4 | 0.6 | 0.5 | 0.8 | 0.55 | 0.85 | 23 | 18 | 20 | 15 | 17 | 10 | 1.5 | 1.0 | 3 | 7-13 | M21 | dd | 49.95 |
| ZDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 0.85 | 1.3 | 0.65 | 1.0 | 0.85 | 1.3 | 32 | 25 | 32 | 25 | 22 | 15 | 1.2 | 1.5 | 3 | 7-9 | M22 | dd | 44.95 |
| ❖ ZDC-10-2 | 250-1000 | 10.5±0.5 | ±0.5 | 1.1 | 1.4 | — | — | 1.6 | 1.9 | 40 | 25 | — | — | 20 | 15 | 1.5 | — | 4 | 7-9 | M22 | dd | 51.95 |
| ZDC-15-2 | 0.5-250 | 15±0.5 | ±0.5 | 0.8 | 1.2 | 0.7 | 1.0 | 0.9 | 1.2 | 32 | 28 | 32 | 28 | 32 | 28 | 1.4 | 1.5 | 3 | 7-20 | M22 | dd | 51.95 |
| ZDC-15-6 | .01-35 | 15±0.5 | ±0.5 | 0.3 | 0.6 | 0.2 | 0.4 | 0.3 | 0.6 | 38 | 30 | 35 | 25 | 28 | 20 | 1.15 | 2 | 4 | 7-11 | M22 | dd | 51.95 |
| ZDC-20-1* | 25-400 | 20±0.5 | ±0.5 | 0.2 | 0.25 | 0.3 | 0.35 | 0.35 | 0.5 | 25 | 20 | 35 | 25 | 25 | 20 | 1.25 | 3 | 5 | 7-12 | M22 | dd | 51.95 |
| ZDC-20-3 | 0.2-250 | 19±0.5 | ±0.5 | 0.35 | 0.6 | 0.25 | 0.5 | 0.35 | 0.6 | 36 | 30 | 33 | 25 | 25 | 20 | 1.2 | 1.5 | 4 | 7-12 | M22 | dd | 44.95 |
| ■ ZDC-10-1-75 | 1-250 | 10.5±0.5 | ±0.75 | 1.1 | 1.5 | 1.1 | 1.5 | 1.1 | 1.5 | 30 | 20 | 30 | 20 | 30 | 20 | 2 | 2 | 4 | 7-16 | M22 | dd | 44.95 |
| ■ ZDC-15-6-75 | .02-35 | 14.5±0.5 | ±0.6 | 0.3 | 0.6 | 0.2 | 0.4 | 0.4 | 0.6 | 35 | 30 | 35 | 25 | 28 | 20 | 1.5 | 2 | 4 | 7-16 | M22 | dd | 52.95 |
| ■ ZDC-20-3-75 | 1-150 | 19.5±0.5 | ±0.75 | 0.35 | 0.8 | 0.35 | 0.8 | 0.35 | 0.8 | 25 | 20 | 25 | 20 | 25 | 20 | 2 | 2 | 4 | 7-17 | M22 | dd | 45.95 |
| ■ ZDC-2375 | 50-100 | 10.5±0.3 | ±0.2 | — | — | — | — | 1.1 | 1.3 | — | — | — | — | 35 | 30 | 1.3 | — | 4 | 7-17 | M22 | dd | 52.95 |
| ■ ZDC-20-3-75-1 | 55-90 | 18.6±0.5 | ±0.3 | 0.4 | 0.6 | 0.4 | 0.6 | 0.4 | 0.6 | 35 | 30 | 35 | 30 | 35 | 30 | 1.2 | — | 4 | 7-22 | M22 | dd | 52.95 |

L = low range ($f_L$ to $10f_L$) M = mid range ($10f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)

## pin and coax connections

see case style outline drawing

| Port | ct | cu | cv | cw | cy | da | db | dc | dd | de |
|---|---|---|---|---|---|---|---|---|---|---|
| Input | 5 | 1 | 1 | 1 | 14 | 8 | 1 | 3 | 3 | S |
| Output | 8 | 4 | 4 | 2 | 8 | 12 | 2 | 1 | 2 | 1 |
| Coupled (forward) | 2 | 3 | 3 | 4 | 5 | 2,1,13,14* | 3 | 2 | 1 | 3 |
| Coupled (reverse) | — | — | 6 | — | — | — | — | — | — | 2 |
| Not Used | 11 | 6 | — | — | — | — | — | — | — | — |
| Case GND | All other pins | 2,5,7,8 | 2,5,7,8 | 3 | All other pins | All other pins | — | — | — | — |

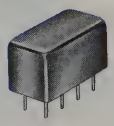
* 4-coupled ports #1, #2, #3, #4 consecutively

CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# Low Pass DC to 1000 MHz



PLP

| | MODEL NO. | PASSBAND, MHz (loss < 1dB) | fco, MHz Nom. (loss 3dB) | STOP BAND, MHz (loss > 20dB) | STOP BAND, MHz (loss > 40dB) | VSWR, Passband Typ. | VSWR, Stopband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLP-1.9** | DC-1.9 | 2.5 | 3.4-4.7 | 4.7-200 | 1.7:1 | 18:1 | — | A01 | cr | 13.95 |
| | PLP-2.5** | DC-2.5 | 2.75 | 3.8-5.0 | 5.0-200 | 1.7:1 | 18:1 | — | A01 | cr | 14.95 |
| | PLP-5 | DC-5 | 6 | 8-10 | 10-200 | 1.7:1 | 18:1 | 8-12 | A01 | cr | 11.45 |
| ■ | PLP-7-75 | DC-7 | 8 | 11-15 | 15-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-10.7 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | 8-12 | A01 | cr | 11.45 |
| ■ | PLP-10.7-75 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-15 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | A01 | cr | 11.45 |
| ■ | PLP-15-75 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-21.4 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | 8-12 | A01 | cr | 11.45 |
| ■ | PLP-21.4-75 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-30 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | 8-13 | A01 | cr | 11.45 |
| ■ | PLP-30-75 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-50 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | 8-13 | A01 | cr | 11.45 |
| ■ | PLP-50-75 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-70 | DC-60 | 67 | 90-117 | 117-300 | 1.7:1 | 18:1 | 8-13 | A01 | cr | 11.45 |
| | PLP-90 | DC-81 | 90 | 121-157 | 157-400 | 1.7:1 | 18:1 | 8-14 | A01 | cr | 11.45 |
| | PLP-100 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | 8-14 | A01 | cr | 11.45 |
| ■ | PLP-100-75 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-150 | DC-140 | 155 | 210-300 | 300-600 | 1.7:1 | 18:1 | 8-14 | A01 | cr | 11.45 |
| | PLP-200 | DC-190 | 210 | 290-390 | 390-800 | 1.7:1 | 18:1 | 8-15 | A01 | cr | 11.45 |
| | PLP-250 | DC-225 | 250 | 320-400 | 400-1200 | 1.7:1 | 18:1 | 8-15 | A01 | cr | 11.45 |
| | PLP-300 | DC-270 | 297 | 410-550 | 550-1200 | 1.7:1 | 18:1 | 8-15 | A01 | cr | 11.45 |
| | PLP-450 | DC-400 | 440 | 580-750 | 750-1800 | 1.7:1 | 18:1 | 8-16 | A01 | cr | 11.45 |
| | PLP-550 | DC-520 | 570 | 750-920 | 920-2000 | 1.7:1 | 18:1 | 8-16 | A01 | cr | 11.45 |
| | PLP-600 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | 8-16 | A01 | cr | 11.45 |
| ■ | PLP-600-75 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-750 | DC-700 | 770 | 1000-1300 | 1300-2000 | 1.7:1 | 18:1 | 8-17 | A01 | cr | 11.45 |
| | PLP-800 | DC-720 | 800 | 1080-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | A01 | cr | 11.45 |
| | PLP-850 | DC-780 | 850 | 1100-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | A01 | cr | 11.45 |
| ■ | PLP-850-75 | DC-750 | 850 | 1150-1490 | 1490-2000 | 1.7:1 | 18:1 | — | A01 | cr | 12.95 |
| | PLP-1000 | DC-900 | 990 | 1340-1750 | 1750-2000 | 1.7:1 | 18:1 | 8-18 | A01 | cr | 11.45 |
| | PLP-1200 | DC-1000 | 1200 | 1620-2100 | 2100-2500 | 1.7:1 | 18:1 | 8-18 | A01 | cr | 11.45 |

NOTES:

** 35 dB for SCLF-380, SCLF-420 and SCLF-550 models
■ Denotes 75 ohm model.
❑ Non-hermetic
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF power, 0.5 Watt

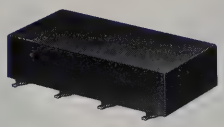
**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PLP-30 | 5915-01-355-9433 |
| PLP-100 | 5915-01-332-1091 |
| PLP-150 | 5915-01-389-3575 |
| PLP-450 | 5915-01-389-8302 |



Mini-Circuits® INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

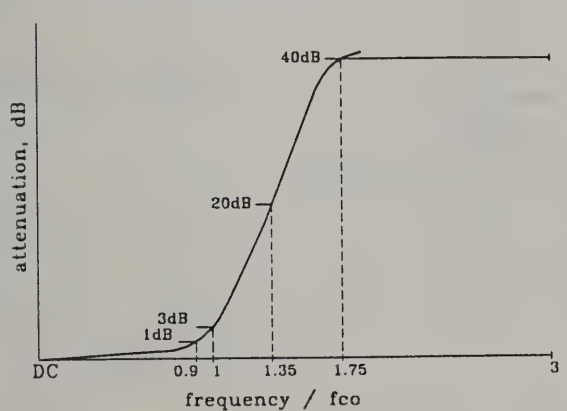
# Low Pass DC to 1000 MHz



SCLF

| MODEL NO. | PASSBAND, MHz (loss < 1dB) | fco, MHz Nom. (loss 3dB) | STOP BAND, MHz (loss > 20dB) | STOP BAND, MHz (loss > 40dB) | VSWR, Passband Typ. | VSWR, Stopband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ (Note 2) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|
| SCLF-5 | DC-5.0 | 5.8 | 8-10 | 10-200 | 1.7:1 | 18:1 | — | YY161 | cr | 14.95 |
| SCLF-8 | DC-8.0 | 9.2 | 12.5-16.5 | 16.5-200 | 1.7:1 | 18:1 | — | YY161 | cr | 12.95 |
| SCLF-10.7 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | -- | YY161 | cr | 12.95 |
| SCLF-21.4 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | 8-19 | YY161 | cr | 11.45 |
| SCLF-25 | DC-25 | 28 | 36-47 | 47-200 | 1.7:1 | 18:1 | -- | YY161 | cr | 11.45 |
| SCLF-30 | DC-30 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | 8-19 | YY161 | cr | 11.45 |
| SCLF-45 | DC-45 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | 8-19 | YY161 | cr | 11.45 |
| SCLF-95 | DC-95 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | -- | YY161 | cr | 11.45 |
| SCLF-135 | DC-135 | 155 | 210-300 | 300-600 | 1.7:1 | 18:1 | 8-20 | YY161 | cr | 11.45 |
| SCLF-190 | DC-190 | 210 | 290-390 | 390-800 | 1.7:1 | 18:1 | 8-20 | YY161 | cr | 11.45 |
| SCLF-225 | DC-225 | 250 | 340-440 | 440-1200 | 1.7:1 | 18:1 | -- | YY161 | cr | 11.45 |
| SCLF-380 | DC-380 | 440 | 580-750 | 750-1800* | 1.7:1 | 18:1 | 8-21 | YY161 | cr | 11.45 |
| SCLF-420 | DC-420 | 570 | 750-920 | 920-2000* | 1.7:1 | 18:1 | 8-21 | YY161 | cr | 11.45 |
| SCLF-550 | DC-550 | 605 | 800-1050 | 1050-2000* | 1.7:1 | 18:1 | — | YY161 | cr | 12.95 |
| SCLF-700 | DC-700 | 770 | 1000-1300 | 1300-2000 | 1.7:1 | 18:1 | -- | YY161 | cr | 12.95 |
| SCLF-1000 | DC-1000 | 1200 | 1620-2100 | 2100-2500 | 1.7:1 | 18:1 | -- | YY161 | cr | 12.95 |

LOW PASS
TYPICAL FREQUENCY RESPONSE




## pin connections

see case style outline drawings

| PORT | cr |
|---|---|
| INPUT | 1 |
| OUTPUT | 8 |
| GND | 2,3,4,5,6,7 |

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

## Low Pass DC to 1000 MHz

| MODEL NO. | PASSBAND, MHz (loss < 1dB) | fco, MHz Nom. (loss 3dB) | STOP BAND, MHz (loss > 20dB) | STOP BAND, MHz (loss > 40dB) | VSWR, Passband Typ. | VSWR, Stopband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ (Note 2) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|
| BLP-1.9** | DC-1.9 | 2.5 | 3.4-4.7 | 4.7-200 | 1.7:1 | 18:1 | — | FF55 | — | 34.95 |
| BLP-2.5** | DC-2.5 | 2.75 | 3.8-5.0 | 5.0-200 | 1.7:1 | 18:1 | — | FF55 | — | 35.95 |
| BLP-5 | DC-5 | 6 | 8-10 | 10-200 | 1.7:1 | 18:1 | 8-12 | FF55 | — | 32.95 |
| ■ BLP-7-75 | DC-7 | 8 | 11-15 | 15-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-10.7 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | 8-12 | FF55 | — | 32.95 |
| ■ BLP-10.7-75 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-15 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | FF55 | — | 32.95 |
| ■ BLP-15-75 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-21.4 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | 8-12 | FF55 | — | 32.95 |
| ■ BLP-21.4-75 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-30 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | 8-13 | FF55 | — | 32.95 |
| ■ BLP-30-75 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-50 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | 8-13 | FF55 | — | 32.95 |
| ■ BLP-50-75 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-70 | DC-60 | 67 | 90-117 | 117-300 | 1.7:1 | 18:1 | 8-13 | FF55 | — | 32.95 |
| BLP-90 | DC-81 | 90 | 121-157 | 157-400 | 1.7:1 | 18:1 | 8-14 | FF55 | — | 32.95 |
| BLP-100 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | 8-14 | FF55 | — | 32.95 |
| ■ BLP-100-75 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-150 | DC-140 | 155 | 210-300 | 300-600 | 1.7:1 | 18:1 | 8-14 | FF55 | — | 32.95 |
| BLP-200 | DC-190 | 210 | 290-390 | 390-800 | 1.7:1 | 18:1 | 8-15 | FF55 | — | 32.95 |
| BLP-250 | DC-225 | 250 | 320-400 | 400-1200 | 1.7:1 | 18:1 | 8-15 | FF55 | — | 32.95 |
| BLP-300 | DC-270 | 297 | 410-550 | 550-1200 | 1.7:1 | 18:1 | 8-15 | FF55 | — | 32.95 |
| BLP-450 | DC-400 | 440 | 580-750 | 750-1800 | 1.7:1 | 18:1 | 8-16 | FF55 | — | 32.95 |
| BLP-550 | DC-520 | 570 | 750-920 | 920-2000 | 1.7:1 | 18:1 | 8-16 | FF55 | — | 32.95 |
| BLP-600 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | 8-16 | FF55 | — | 32.95 |
| ■ BLP-600-75 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-750 | DC-700 | 770 | 1000-1300 | 1300-2000 | 1.7:1 | 18:1 | 8-17 | FF55 | — | 32.95 |
| BLP-800 | DC-720 | 800 | 1080-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF55 | — | 32.95 |
| BLP-850 | DC-780 | 850 | 1100-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF55 | — | 32.95 |
| ■ BLP-850-75 | DC-750 | 850 | 1150-1490 | 1490-2000 | 1.7:1 | 18:1 | — | FF55 | — | 33.95 |
| BLP-1000 | DC-900 | 990 | 1340-1750 | 1750-2000 | 1.7:1 | 18:1 | 8-18 | FF55 | — | 32.95 |
| BLP-1200 | DC-1000 | 1200 | 1620-2100 | 2100-2500 | 1.7:1 | 18:1 | 8-18 | FF55 | — | 32.95 |

NOTES:

** 1dB compression at +13 dBm input power

■ Denotes 75 ohm model, for coax connector models 75 ohm BNC connectors are standard.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

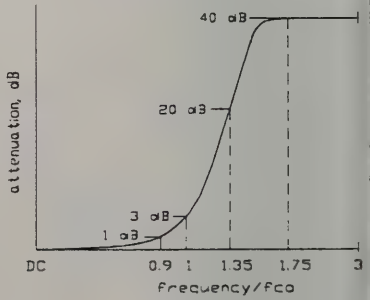
1. Absolute maximum power, voltage and current rating: 1a. RF power, 0.5 Watt

2. Models are available with male/female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| SLP-30 | 5915-01-327-4692 |
| SLP-21.4 | 5915-01-414-9165 |

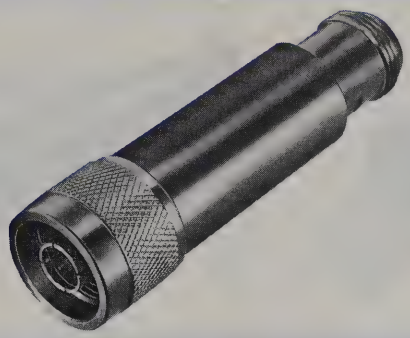
LOW PASS
TYPICAL FREQUENCY RESPONSE



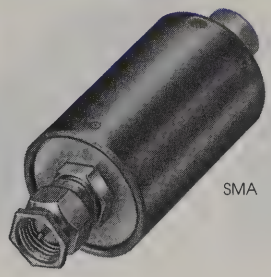



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

TYPE N



NLP



SMA

SLP

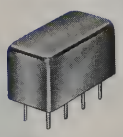
| MODEL NO. | PASSBAND, MHz (loss < 1dB) | fco, MHz Nom. (loss 3dB) | STOP BAND, MHz (loss > 20dB) | STOP BAND, MHz (loss > 40dB) | VSWR, Passband Typ. | VSWR, Stopband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ (Note 2) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|
| NLP-1.9** | DC-1.9 | 2.5 | 3.4-4.7 | 4.7-200 | 1.7:1 | 18:1 | — | FF57 | — | 37.95 |
| NLP-2.5** | DC-2.5 | 2.75 | 3.8-5.0 | 5.0-200 | 1.7:1 | 18:1 | — | FF57 | — | 38.95 |
| NLP-5 | DC-5 | 6 | 8-10 | 10-200 | 1.7:1 | 18:1 | 8-12 | FF57 | — | 35.95 |
| NLP-10.7 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | 8-12 | FF57 | — | 35.95 |
| NLP-15 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | FF57 | — | 35.95 |
| NLP-21.4 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | 8-12 | FF57 | — | 35.95 |
| NLP-30 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | 8-13 | FF57 | — | 35.95 |
| NLP-50 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | 8-13 | FF57 | — | 35.95 |
| NLP-70 | DC-60 | 67 | 90-117 | 117-300 | 1.7:1 | 18:1 | 8-13 | FF57 | — | 35.95 |
| NLP-90 | DC-81 | 90 | 121-157 | 157-400 | 1.7:1 | 18:1 | 8-14 | FF57 | — | 35.95 |
| NLP-100 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | 8-14 | FF57 | — | 35.95 |
| NLP-150 | DC-140 | 155 | 210-300 | 300-600 | 1.7:1 | 18:1 | 8-14 | FF57 | — | 35.95 |
| NLP-200 | DC-190 | 210 | 290-390 | 390-800 | 1.7:1 | 18:1 | 8-15 | FF57 | — | 35.95 |
| NLP-250 | DC-225 | 250 | 320-400 | 400-1200 | 1.7:1 | 18:1 | 8-15 | FF57 | — | 35.95 |
| NLP-300 | DC-270 | 297 | 410-550 | 550-1200 | 1.7:1 | 18:1 | 8-15 | FF57 | — | 35.95 |
| NLP-450 | DC-400 | 440 | 580-750 | 750-1800 | 1.7:1 | 18:1 | 8-16 | FF57 | — | 35.95 |
| NLP-550 | DC-520 | 570 | 750-920 | 920-2000 | 1.7:1 | 18:1 | 8-16 | FF57 | — | 35.95 |
| NLP-600 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | 8-16 | FF57 | — | 35.95 |
| NLP-750 | DC-700 | 770 | 1000-1300 | 1300-2000 | 1.7:1 | 18:1 | 8-17 | FF57 | — | 35.95 |
| NLP-800 | DC-720 | 800 | 1080-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF57 | — | 35.95 |
| NLP-850 | DC-780 | 850 | 1100-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF57 | — | 35.95 |
| NLP-1000 | DC-900 | 990 | 1340-1750 | 1750-2000 | 1.7:1 | 18:1 | 8-18 | FF57 | — | 35.95 |
| NLP-1200 | DC-1000 | 1200 | 1620-2100 | 2100-2500 | 1.7:1 | 18:1 | 8-18 | FF57 | — | 35.95 |
| SLP-1.9** | DC-1.9 | 2.5 | 3.4-4.7 | 4.7-200 | 1.7:1 | 18:1 | — | FF99 | — | 36.95 |
| SLP-2.5** | DC-2.5 | 2.75 | 3.8-5.0 | 5.0-200 | 1.7:1 | 18:1 | — | FF99 | — | 37.95 |
| SLP-5 | DC-5 | 6 | 8-10 | 10-200 | 1.7:1 | 18:1 | 8-12 | FF99 | — | 34.95 |
| SLP-10.7 | DC-11 | 14 | 19-24 | 24-200 | 1.7:1 | 18:1 | 8-12 | FF99 | — | 34.95 |
| SLP-15 | DC-15 | 17 | 23-32 | 32-200 | 1.7:1 | 18:1 | — | FF99 | — | 34.95 |
| SLP-21.4 | DC-22 | 24.5 | 32-41 | 41-200 | 1.7:1 | 18:1 | 8-12 | FF99 | — | 34.95 |
| SLP-30 | DC-32 | 35 | 47-61 | 61-200 | 1.7:1 | 18:1 | 8-13 | FF99 | — | 34.95 |
| SLP-50 | DC-48 | 55 | 70-90 | 90-200 | 1.7:1 | 18:1 | 8-13 | FF99 | — | 34.95 |
| SLP-70 | DC-60 | 67 | 90-117 | 117-300 | 1.7:1 | 18:1 | 8-13 | FF99 | — | 34.95 |
| SLP-90 | DC-81 | 90 | 121-157 | 157-400 | 1.7:1 | 18:1 | 8-14 | FF99 | — | 34.95 |
| SLP-100 | DC-98 | 108 | 146-189 | 189-400 | 1.7:1 | 18:1 | 8-14 | FF99 | — | 34.95 |
| SLP-150 | DC-140 | 155 | 210-300 | 300-600 | 1.7:1 | 18:1 | 8-14 | FF99 | — | 34.95 |
| SLP-200 | DC-190 | 210 | 290-390 | 390-800 | 1.7:1 | 18:1 | 8-15 | FF99 | — | 34.95 |
| SLP-250 | DC-225 | 250 | 320-400 | 400-1200 | 1.7:1 | 18:1 | 8-15 | FF99 | — | 34.95 |
| SLP-300 | DC-270 | 297 | 410-550 | 550-1200 | 1.7:1 | 18:1 | 8-15 | FF99 | — | 34.95 |
| SLP-450 | DC-400 | 440 | 580-750 | 750-1800 | 1.7:1 | 18:1 | 8-16 | FF99 | — | 34.95 |
| SLP-550 | DC-520 | 570 | 750-920 | 920-2000 | 1.7:1 | 18:1 | 8-16 | FF99 | — | 34.95 |
| SLP-600 | DC-580 | 640 | 840-1120 | 1120-2000 | 1.7:1 | 18:1 | 8-16 | FF99 | — | 34.95 |
| SLP-750 | DC-700 | 770 | 1000-1300 | 1300-2000 | 1.7:1 | 18:1 | 8-17 | FF99 | — | 34.95 |
| SLP-800 | DC-720 | 800 | 1080-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF99 | — | 34.95 |
| SLP-850 | DC-780 | 850 | 1100-1400 | 1400-2000 | 1.7:1 | 18:1 | 8-17 | FF99 | — | 34.95 |
| SLP-1000 | DC-900 | 990 | 1340-1750 | 1750-2000 | 1.7:1 | 18:1 | 8-18 | FF99 | — | 34.95 |
| SLP-1200 | DC-1000 | 1200 | 1620-2100 | 2100-2500 | 1.7:1 | 18:1 | 8-18 | FF99 | — | 34.95 |

CAPD now available! computer-automated performance data

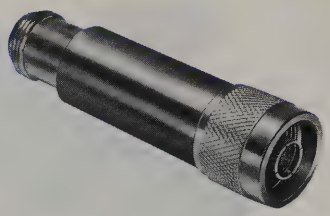
## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

## BANDPASS 10.7 to 70 MHz



PIF
PBP
PBLP



NIF
NBP
NBLP

### constant impedance

| MODEL NO. | CENTER FREQ. MHz | PASSBAND, MHz (loss < 1dB) | STOP BANDS (loss > 10dB) at MHz | STOP BANDS (loss > 20dB) at MHz | VSWR, 1.3:1, Typ. TOTAL BAND, MHz | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection * | PRICE $ (note 2a) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|
| _IF-21.4 | 21.4 | 18-25 | 4.9 & 85 | 1.3 & 150 | DC-220 | 8-22 | ▽ | cs | 14.95 |
| _IF-30 | 30 | 25-35 | 7 & 120 | 1.9 & 210 | DC-330 | 8-22 | ▽ | cs | 14.95 |
| _IF-40 | 42 | 35-49 | 10 & 168 | 2.6 & 300 | DC-400 | 8-22 | ▽ | cs | 14.95 |
| _IF-50 | 50 | 41-58 | 11.5 & 200 | 3.1 & 350 | DC-440 | 8-23 | ▽ | cs | 14.95 |
| _IF-60 | 60 | 50-70 | 14 & 240 | 3.8 & 400 | DC-500 | 8-23 | ▽ | cs | 14.95 |
| _IF-70 | 70 | 58-82 | 16 & 280 | 4.4 & 490 | DC-550 | 8-23 | ▽ | cs | 14.95 |

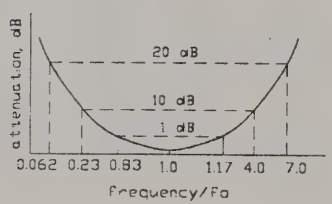
For connector selection, add prefix letter P, B, N or S to _IF where applicable (see note 2)

### elliptic response

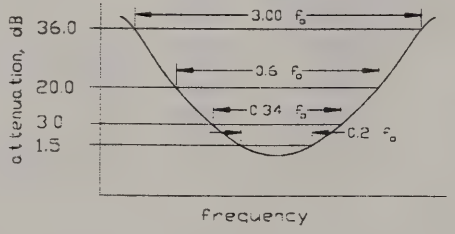
| MODEL NO. | CENTER FREQ. MHz | PASSBAND I.L. 1.5 dB MAX. (MHz) | 3 dB BANDWIDTH TYPICAL (MHz) | STOP BANDS I.L. > 20 dB at MHz | STOP BANDS I.L. > 35 dB at MHz | PASSBAND VSWR MAX. | STOP BAND VSWR TYPICAL | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection * | PRICE $ (note 2b) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| _BP-10.7 | 10.7 | 9.5-11.5 | 8.9-12.7 | 7.5 & 15 | 0.6 & 50-1000 | 1.7:1 | 16:1 | 8-24 | ▽ | cr | 18.95 |
| _BP-21.4 | 21.4 | 19.2-23.6 | 17.9-25.3 | 15.5 & 29 | 3.0 & 80-1000 | 1.7:1 | 16:1 | 8-24 | ▽ | cr | 18.95 |
| _BP-30 | 30 | 27.0-33.0 | 25-35 | 22 & 40 | 3.2 & 99-1000 | 1.7:1 | 16:1 | 8-24 | ▽ | cr | 18.95 |
| _BP-60 | 60 | 55.0-67.0 | 49.8-70.5 | 44 & 79 | 4.6 & 190-1000 | 1.7:1 | 16:1 | 8-25 | ▽ | cr | 18.95 |
| _BP-70 | 70 | 63.0-77.0 | 58.0-82.0 | 51 & 94 | 6.0 & 193-1000 | 1.7:1 | 16:1 | 8-25 | ▽ | cr | 18.95 |

For connector selection, add prefix letter P, B, N or S to _BP where applicable (see note 2)

BANDPASS, CONSTANT IMPEDANCE
TYPICAL FREQUENCY RESPONSE




BANDPASS, ELLIPTICAL
TYPICAL FREQUENCY RESPONSE

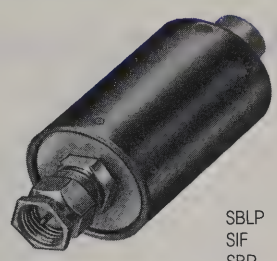





Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# LOW PASS, FLAT TIME DELAY DC to 1.87 GHz

BBLP
BIF
BBP



SBLP
SIF
SBP

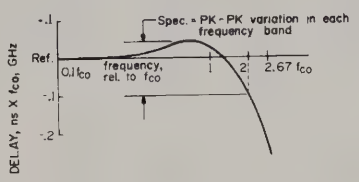
| MODEL NO. | PASSBAND, MHz (loss < 1.2 dB) Min. | fco, MHz (loss 3dB) Nom. | STOP BAND, MHz loss > 10dB | STOP BAND, MHz loss > 20dB | VSWR DC-0.2fco $\overline{X}$ | VSWR DC-0.6fco $\overline{X}$ | GROUP DELAY VARIATION, ns DC-fco $\overline{X}$ | GROUP DELAY VARIATION, ns DC-2fco $\overline{X}$ | GROUP DELAY VARIATION, ns DC-2.67fco $\overline{X}$ | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ (Note 2c) Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| _BLP-39 | DC-23 | 39 | 78-117 | 117 | 1.3:1 | 2.3:1 | 0.70 | 4.0 | 5.00 | 8-31 | ▽ | cr | 19.95 |
| _BLP-117 | DC-65 | 117 | 234-312 | 312 | 1.3:1 | 2.4:1 | 0.35 | 1.4 | 1.90 | 8-31 | ▽ | cr | 19.95 |
| _BLP-156 | DC-94 | 156 | 312-416 | 416 | 1.3:1 | 1.1:1 | 0.30 | 1.1 | 1.50 | 8-31 | ▽ | cr | 19.95 |
| _BLP-200 | DC-120 | 200 | 400-534 | 534 | 1.6:1 | 1.9:1 | 0.40 | 1.3 | 1.60 | 8-32 | ▽ | cr | 19.95 |
| _BLP-300 | DC-180 | 300 | 600-801 | 801 | 1.25:1 | 2.2:1 | 0.20 | 0.6 | 0.80 | 8-32 | ▽ | cr | 19.95 |
| _BLP-467 | DC-280 | 467 | 934-1246 | 1246 | 1.25:1 | 2.2:1 | 0.15 | 0.4 | 0.55 | 8-32 | ▽ | cr | 19.95 |
| ▼ _BLP-933 | DC-560 | 933 | 1866-2490 | 2490 | 1.3:1 | 2.2:1 | 0.09 | 0.2 | 0.28 | 8-33 | ▽ | --- | 38.95 |
| ▼ _BLP-1870 | DC-850 | 1870 | 3740-5000 | 5000 | 1.45:1 | 2.9:1 | 0.05 | 0.1 | 0.15 | 8-33 | ▽ | --- | 38.95 |

For connector selection, add prefix letter P, B, N, or S to _BLP where applicable (see note 2)

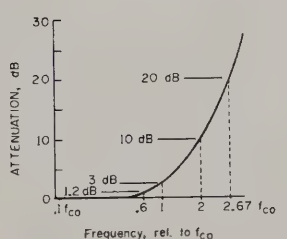
## features

- Flat group delay for low pulse distortion.
- Delay and selectivity are both controlled by design.
- Wide selection of cutoff frequencies, 48-to-1 range. Custom Fco values are available.
- Choice of pin package or connectorized models.

TYPICAL GROUP DELAY




TYPICAL FREQUENCY RESPONSE
Insertion Loss




NOTES:

* Connection for plug-in models (PIF, PBP, PBLP)
▼ _BLP-933 AND _BLP-1870 available only with N and SMA connectors.
▽ Four different case styles available:
For plug-in models, case style A01
SMA connector models, case style FF99
BNC connector models, case style FF55
N-type connector models, case style FF57
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF power, 0.5 Watt
2. 2a. Price for PIF-series only, SIF $38.95, BIF $36.95, NIF $39.95
2b Price for PBP-series only, SBP $42.95, BBP $40.95, NBP $43.95
2c. Price for PBLP-series only, SBLP $38.95, BBLP $36.95, NBLP $39.95
3. Models are available with male/ female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.
4. All filters, except pin units (PIF, PBP and PBLP), are non-hermetic.

## pin connections

see case style outline drawings

| PORT | cr | cs |
|---|---|---|
| INPUT | 1 | 1 |
| OUTPUT | 8 | 6 |
| GND | 2,3,4,5,6,7 | 2,3,4,5,7,8 |

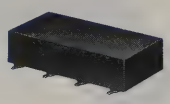
CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

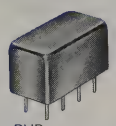
For Custom Versions Of Standard Models Consult Our Applications Dept.

# HIGH PASS 25 MHz to 2.2 GHz

SURFACE MOUNT



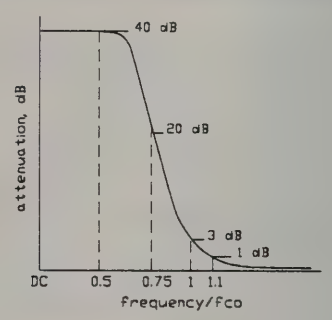
SCHF



PHP

| | MODEL NO. | STOP BAND, MHz (loss > 40dB) | STOP BAND, MHz (loss > 20dB) | fco, MHz Nom. (loss 3dB) | PASSBAND, MHz (loss < 1dB) | VSWR, Stopband Typ. | VSWR, Passband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | SCHF-25 | DC-13 | 13-19 | 25 | 27.5-200 | 18:1 | 1.3:1 | --- | YY161 | cr | 14.95 |
| NEW | SCHF-300 | DC-145 | 145-190 | 245 | 290-1200 | 18:1 | 1.5:1 | --- | YY161 | cr | 14.95 |
| | PHP-25 | DC-13 | 13-19 | 25 | 27.5-200 | 18:1 | 1.7:1 | 8-26 | A01 | cr | 16.95 |
| | PHP-50 | DC-20 | 20-26 | 37 | 41-200 | 17:1 | 1.5:1 | 8-26 | A01 | cr | 14.95 |
| | PHP-100 | DC-40 | 40-55 | 82 | 90-400 | 17:1 | 1.5:1 | 8-26 | A01 | cr | 14.95 |
| | PHP-150 | DC-70 | 70-95 | 120 | 133-600 | 17:1 | 1.8:1 | 8-27 | A01 | cr | 14.95 |
| | PHP-175 | DC-70 | 70-105 | 140 | 160-800 | 17:1 | 1.5:1 | 8-27 | A01 | cr | 14.95 |
| | PHP-200 | DC-90 | 90-116 | 164 | 185-800 | 17:1 | 1.6:1 | 8-27 | A01 | cr | 14.95 |
| | PHP-250 | DC-100 | 100-150 | 205 | 225-1200 | 17:1 | 1.3:1 | 8-28 | A01 | cr | 14.95 |
| | PHP-300 | DC-145 | 145-170 | 245 | *290-1200 | 17:1 | 1.7:1 | 8-28 | A01 | cr | 14.95 |
| | PHP-400 | DC-210 | 210-290 | 360 | 395-1600 | 17:1 | 1.7:1 | 8-28 | A01 | cr | 14.95 |
| | PHP-500 | DC-280 | 280-365 | 454 | 500-1600 | 17:1 | 1.9:1 | 8-29 | A01 | cr | 14.95 |
| | PHP-600 | DC-350 | 350-440 | 545 | 600-1600 | 17:1 | 2.0:1 | 8-29 | A01 | cr | 14.95 |
| | PHP-700 | DC-400 | 400-520 | 640 | 700-1800 | 17:1 | 1.6:1 | 8-29 | A01 | cr | 14.95 |
| | PHP-800 | DC-445 | 445-570 | 710 | 780-2000 | 17:1 | 2.1:1 | 8-30 | A01 | cr | 14.95 |
| | PHP-900 | DC-520 | 520-660 | 820 | 910-2100 | 17:1 | 1.8:1 | 8-30 | A01 | cr | 14.95 |
| | PHP-1000 | DC-550 | 550-720 | 900 | 1000-2200 | 17:1 | 1.9:1 | 8-30 | A01 | cr | 14.95 |

HIGH PASS
TYPICAL FREQUENCY RESPONSE




NOTES:

* Insertion loss 1.5 dB maximum

❑ Non-hermetic

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current rating:
   1a. RF power, 0.5 Watt

2. Models are available with male/female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.

## pin connections

see case style outline drawings

| PORT | cr |
|---|---|
| INPUT | 1 |
| OUTPUT | 8 |
| GND | 2,3,4,5,6,7 |

## NSN GUIDE

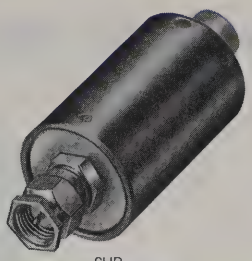
| MCL NO. | NSN |
|---|---|
| BHP-25 | 5915-01-425-7519 |
| SHP-200 | 5915-01-360-0677 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

BHP

NHP



SHP

| MODEL NO. | STOP BAND, MHz (loss > 40dB) | (loss > 20dB) | fco, MHz Nom. (loss 3dB) | PASSBAND, MHz (loss < 1dB) | VSWR, Stopband Typ. | Passband Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|
| BHP-25 | DC-13 | 13- 19 | 25 | 27.5-200 | 18:1 | 1.7:1 | 8-26 | FF55 | - | 38.95 |
| BHP-50 | DC-20 | 20- 26 | 37 | 41-200 | 17:1 | 1.5:1 | 8-26 | FF55 | - | 36.95 |
| BHP-100 | DC-40 | 40- 55 | 82 | 90-400 | 17:1 | 1.5:1 | 8-26 | FF55 | - | 36.95 |
| BHP-150 | DC-70 | 70- 95 | 120 | 133-600 | 17:1 | 1.8:1 | 8-27 | FF55 | - | 36.95 |
| BHP-175 | DC-70 | 70-105 | 140 | 160-800 | 17:1 | 1.5:1 | 8-27 | FF55 | - | 36.95 |
| BHP-200 | DC-90 | 90-116 | 164 | 185-800 | 17:1 | 1.6:1 | 8-27 | FF55 | - | 36.95 |
| BHP-250 | DC-100 | 100-150 | 205 | 225-1200 | 17:1 | 1.3:1 | 8-28 | FF55 | - | 36.95 |
| BHP-300 | DC-145 | 145-190 | 245 | *290-1200 | 17:1 | 1.7:1 | 8-28 | FF55 | - | 36.95 |
| BHP-400 | DC-210 | 210-290 | 360 | 395-1600 | 17:1 | 1.7:1 | 8-28 | FF55 | - | 36.95 |
| BHP-500 | DC-280 | 280-365 | 454 | 500-1600 | 17:1 | 1.9:1 | 8-29 | FF55 | - | 36.95 |
| BHP-600 | DC-350 | 350-440 | 545 | 600-1600 | 17:1 | 2.0:1 | 8-29 | FF55 | - | 36.95 |
| BHP-700 | DC-400 | 400-520 | 640 | 700-1800 | 17:1 | 1.6:1 | 8-29 | FF55 | - | 36.95 |
| BHP-800 | DC-445 | 445-570 | 710 | 780-2000 | 17:1 | 2.1:1 | 8-30 | FF55 | - | 36.95 |
| BHP-900 | DC-520 | 520-660 | 820 | 910-2100 | 17:1 | 1.8:1 | 8-30 | FF55 | - | 36.95 |
| BHP-1000 | DC-550 | 550-720 | 900 | 1000-2200 | 17:1 | 1.9:1 | 8-30 | FF55 | - | 36.95 |
| NHP-25 | DC-13 | 13- 19 | 25 | 27.5-200 | 18:1 | 1.7:1 | 8-26 | FF57 | - | 39.95 |
| NHP-50 | DC-20 | 20- 26 | 37 | 41-200 | 17:1 | 1.5:1 | 8-26 | FF57 | - | 39.95 |
| NHP-100 | DC-40 | 40- 55 | 82 | 90-400 | 17:1 | 1.5:1 | 8-26 | FF57 | - | 39.95 |
| NHP-150 | DC-70 | 70- 95 | 120 | 133-600 | 17:1 | 1.8:1 | 8-27 | FF57 | - | 39.95 |
| NHP-175 | DC-70 | 70-105 | 140 | 160-800 | 17:1 | 1.5:1 | 8-27 | FF57 | - | 39.95 |
| NHP-200 | DC-90 | 90-116 | 164 | 185-800 | 17:1 | 1.6:1 | 8-27 | FF57 | - | 39.95 |
| NHP-250 | DC-100 | 100-150 | 205 | 225-1200 | 17:1 | 1.3:1 | 8-28 | FF57 | - | 39.95 |
| NHP-300 | DC-145 | 145-190 | 245 | *290-1200 | 17:1 | 1.7:1 | 8-28 | FF57 | - | 39.95 |
| NHP-400 | DC-210 | 210-290 | 360 | 395-1600 | 17:1 | 1.7:1 | 8-28 | FF57 | - | 39.95 |
| NHP-500 | DC-280 | 280-365 | 454 | 500-1600 | 17:1 | 1.9:1 | 8-29 | FF57 | - | 39.95 |
| NHP-600 | DC-350 | 350-440 | 545 | 600-1600 | 17:1 | 2.0:1 | 8-29 | FF57 | - | 39.95 |
| NHP-700 | DC-400 | 400-520 | 640 | 700-1800 | 17:1 | 1.6:1 | 8-29 | FF57 | - | 39.95 |
| NHP-800 | DC-445 | 445-570 | 710 | 780-2000 | 17:1 | 2.1:1 | 8-30 | FF57 | - | 39.95 |
| NHP-900 | DC-520 | 520-660 | 820 | 910-2100 | 17:1 | 1.8:1 | 8-30 | FF57 | - | 39.95 |
| NHP-1000 | DC-550 | 550-720 | 900 | 1000-2200 | 17:1 | 1.9:1 | 8-30 | FF57 | - | 39.95 |
| SHP-25 | DC-13 | 13- 19 | 25 | 27.5-200 | 18:1 | 1.7:1 | 8-26 | FF99 | - | 38.95 |
| SHP-50 | DC-20 | 20- 26 | 37 | 41-200 | 17:1 | 1.5:1 | 8-26 | FF99 | - | 38.95 |
| SHP-100 | DC-40 | 40- 55 | 82 | 90-400 | 17:1 | 1.5:1 | 8-26 | FF99 | - | 38.95 |
| SHP-150 | DC-70 | 70- 95 | 120 | 133-600 | 17:1 | 1.8:1 | 8-27 | FF99 | - | 38.95 |
| SHP-175 | DC-70 | 70-105 | 140 | 160-800 | 17:1 | 1.5:1 | 8-27 | FF99 | - | 38.95 |
| SHP-200 | DC-90 | 90-116 | 164 | 185-800 | 17:1 | 1.6:1 | 8-27 | FF99 | - | 38.95 |
| SHP-250 | DC-100 | 100-150 | 205 | 225-1200 | 17:1 | 1.3:1 | 8-28 | FF99 | - | 38.95 |
| SHP-300 | DC-145 | 145-190 | 245 | *290-1200 | 17:1 | 1.7:1 | 8-28 | FF99 | - | 38.95 |
| SHP-400 | DC-210 | 210-290 | 360 | 395-1600 | 17:1 | 1.7:1 | 8-28 | FF99 | - | 38.95 |
| SHP-500 | DC-280 | 280-365 | 454 | 500-1600 | 17:1 | 1.9:1 | 8-29 | FF99 | - | 38.95 |
| SHP-600 | DC-350 | 350-440 | 545 | 600-1600 | 17:1 | 2.0:1 | 8-29 | FF99 | - | 38.95 |
| SHP-700 | DC-400 | 400-520 | 640 | 700-1800 | 17:1 | 1.6:1 | 8-29 | FF99 | - | 38.95 |
| SHP-800 | DC-445 | 445-570 | 710 | 780-2000 | 17:1 | 2.1:1 | 8-30 | FF99 | - | 38.95 |
| SHP-900 | DC-520 | 520-660 | 820 | 910-2100 | 17:1 | 1.8:1 | 8-30 | FF99 | - | 38.95 |
| SHP-1000 | DC-550 | 550-720 | 900 | 1000-2200 | 17:1 | 1.9:1 | 8-30 | FF99 | - | 38.95 |

CAPD now available! computer-automated performance data

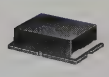
## In Stock... Immediate Delivery

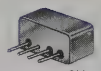
For Custom Versions Of Standard Models Consult Our Applications Dept.

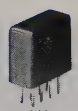
# FREQUENCY DOUBLERS 50Ω Surface Mount

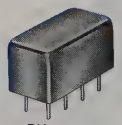
## HIGH HARMONIC REJECTION 5 kHz to 3000 MHz

SURFACE MOUNT

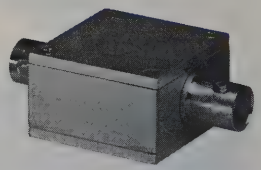

SYK


SK


AK


RK

FD


FK

| MODEL NO. | FREQUENCY MHz Input | FREQUENCY MHz Output | RF INPUT PWR. dBm Min. | RF INPUT PWR. dBm Max. | CONVERSION LOSS dB Input freq. | CONVERSION LOSS dB Typ. | CONVERSION LOSS dB Max. | *HARMONIC OUTPUT, dB F1 Typ. | F1 Min. | F3 Typ. | F3 Min. | F4 Typ. | F4 Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SYK-2R | 10-1000 | 20-2000 | 12 | 16 | 10-500<br>500-1000 | 10.5<br>11.5 | 14.0<br>16.0 | 35<br>32 | 25<br>20 | 42<br>37 | 25<br>20 | 20<br>20 | 10<br>10 | — | TTT167 | gc | 29.95 |
| SK-2 | 1-500 | 2-1000 | 1 | 10 | 1-100<br>100-300<br>300-500 | 13.0<br>13.5<br>14.0 | 15.0<br>15.5<br>17.5 | 40<br>25<br>20 | 30<br>20<br>15 | 50<br>40<br>30 | 40<br>30<br>25 | 16<br>16<br>16 | 12<br>12<br>12 | 9-6 | B02 | df | 26.45 |
| AK-2 | 1-500 | 2-1000 | 1 | 10 | 1-100<br>100-300<br>300-500 | 13.0<br>13.5<br>14.0 | 15.0<br>15.5<br>17.5 | 40<br>25<br>20 | 30<br>20<br>15 | 50<br>40<br>30 | 40<br>30<br>25 | 16<br>16<br>16 | 12<br>12<br>12 | 9-6 | A03 | dg | 20.95 |
| AK-3000 | 70-1500 | 140-3000 | 12 | 15 | 70-1000<br>1000-1500 | 10.5<br>11.5 | 14.0<br>16.0 | 31<br>22 | 20<br>15 | 40<br>30 | 25<br>20 | 14<br>30 | 10<br>14 | 9-8 | A03 | ga | 59.95 |
| RK-2 | 5-500 | 10-1000 | 1 | 15 | 5-100<br>100-300<br>300-500 | 13.0<br>13.5<br>14.0 | 16.0<br>15.5<br>16.5 | 40<br>25<br>20 | 30<br>20<br>15 | 50<br>40<br>30 | 40<br>30<br>25 | 16<br>16<br>16 | 12<br>12<br>12 | 9-6 | A01 | dg | 17.95 |
| RK-3 | 0.05-150 | 0.1-300 | 0 | 13 | 0.05-50<br>50-150 | 11.0<br>11.5 | 13.0<br>15.0 | 40<br>35 | 30<br>20 | 45<br>40 | 30<br>20 | 16<br>16 | 12<br>12 | 9-6 | A01 | dh | 15.95 |
| RK-5 | 10-800 | 20-1600 | 10 | 20 | 10-100<br>100-400<br>400-800 | 13.0<br>12.5<br>13.0 | 15.0<br>16.0<br>16.0 | 20<br>20<br>20 | 12<br>12<br>12 | 25<br>30<br>25 | 20<br>20<br>18 | 15<br>15<br>15 | 12<br>12<br>10 | 9-7 | A01 | dg | 49.95 |
| RK-6 | 0.005-25 | 0.01-50 | 0 | 10 | 0.005-1<br>1-25 | 11.0<br>11.5 | 13.0<br>15.0 | 40<br>35 | 30<br>20 | 45<br>40 | 30<br>20 | 16<br>16 | 12<br>12 | 9-8 | A01 | dj | 25.95 |
| RK-3000 | 70-1500 | 140-3000 | 12 | 15 | 70-1000<br>1000-1500 | 11.0<br>12.0 | 14.0<br>17.5 | 31<br>22 | 20<br>15 | 40<br>30 | 25<br>20 | 15<br>30 | 10<br>14 | 9-8 | A01 | ga | 54.95 |
| FD-2 | 5-500 | 10-1000 | 1 | 15 | 5-100<br>100-300<br>300-500 | 13.0<br>13.5<br>14.0 | 16.0<br>15.5<br>16.5 | 40<br>25<br>20 | 30<br>20<br>15 | 50<br>40<br>30 | 40<br>30<br>25 | 16<br>16<br>16 | 12<br>12<br>12 | 9-6 | FF55 | - | 40.95 |
| FK-5 | 10-1000 | 20-2000 | 10** | 20 | 10-600<br>600-1000 | 13.0<br>14.0 | 15.0<br>17.0 | 20<br>20 | 10<br>10 | 16<br>25 | 20<br>20 | 15<br>25 | 10<br>15 | 9-7 | H16 | - | 69.95 |
| △ FK-3000 | 70-1500 | 140-3000 | 12 | 15 | 70-1000<br>1000-1500 | 11.0<br>12.0 | 14.0<br>17.5 | 31<br>22 | 20<br>15 | 40<br>30 | 25<br>20 | 15<br>30 | 10<br>14 | 9-8 | H16 | - | 79.95 |

### NSN GUIDE

| MCL NO. | NSN | | |
|---|---|---|---|
| AK-2 | 5895-01-131-4569 | RK-2 | 5895-01-268-7337 |
| FD-2 | 5895-00-087-7925 | RK-3 | 5895-01-143-3726 |
| FK-5 | 5985-01-204-9746 | RK-3-TX | 5895-01-160-8656 |
| MK-3BR | 5895-01-332-8582 | SK-2 | 6625-01-247-8425 |

### pin connections

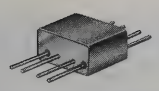
see case style outline drawings for pin locations

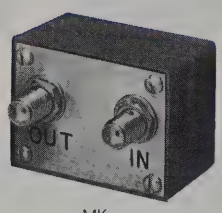
| PORT | df | dg | dh | dj | dk | ga | gc |
|---|---|---|---|---|---|---|---|
| INPUT | 1,2 ^ | 1,3,4 ^ | 1,3,4 ^ | 1,3,4 ^ | 4 | 1 | 2 |
| OUTPUT | 4 | 8 | 8 | 8 | 8 | 8 | 1 |
| GND EXT. | 3 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 1,2,3,5,6,7 | 2,3,4,5,6,7 | 4 |
| CASE GND | 3 | 2,5,6,7 | 2 | — | 1,2,3,5,6,7 | 2,3,4,5,6,7 | 4 |
| NOT USED | — | — | — | — | — | — | 3 |

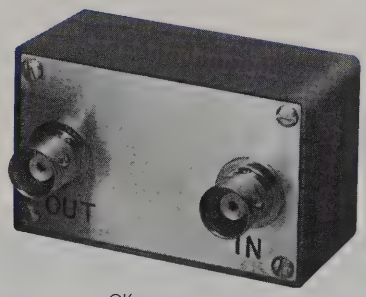
^ pins must be connected together externally



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



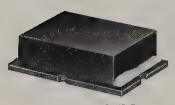



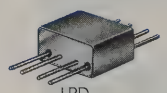

| MODEL NO. | FREQUENCY MHz | | RF INPUT PWR. dBm | | CONVERSION LOSS dB | | | *HARMONIC OUTPUT, dB | | | | | | CAPD DATA (see RF/IF Designer handbook) | CASE STYLE | CONNECTION | PRICE $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | F1 | | F3 | | F4 | | | | | |
| | Input | Output | Min. | Max. | Input freq. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Page | Note B | | Qty. (1-9) |
| LK-3000 | 70-1500 | 140-3000 | 12 | 15 | 70-1000 | 10.5 | 14.0 | 31 | 20 | 40 | 25 | 15 | 10 | 9-8 | BB48 | dk | 64.95 |
| | | | | | 1000-1500 | 11.5 | 16.0 | 22 | 15 | 35 | 20 | 20 | 14 | | | | |
| MK-2 | 5-500 | 10-1000 | 1 | 15 | 5-100 | 13.0 | 16.0 | 40 | 30 | 50 | 40 | 16 | 12 | 9-6 | L19 | - | 52.95 |
| | | | | | 100-300 | 13.5 | 15.5 | 25 | 20 | 40 | 30 | 16 | 12 | | | | |
| | | | | | 300-500 | 14.0 | 16.5 | 20 | 15 | 30 | 25 | 16 | 12 | | | | |
| MK-3 | 0.05-150 | 0.1-300 | 0 | 13 | 0.05-50 | 11.0 | 13.0 | 40 | 30 | 45 | 30 | 16 | 12 | 9-6 | L19 | - | 47.95 |
| | | | | | 50-150 | 11.5 | 15.0 | 35 | 20 | 40 | 20 | 16 | 12 | | | | |
| MK-5 | 10-1000 | 20-2000 | 10** | 20 | 10-600 | 13.0 | 15.0 | 20 | 10 | 26 | 20 | 15 | 10 | 9-7 | L19 | - | 76.95 |
| | | | | | 600-1000 | 14.0 | 17.0 | 20 | 10 | 25 | 20 | 25 | 15 | | | | |
| GK-2 | 5-500 | 10-1000 | 1 | 15 | 5-100 | 13.0 | 16.0 | 40 | 30 | 50 | 40 | 16 | 12 | 9-6 | L20 | - | 45.95 |
| | | | | | 100-300 | 13.5 | 15.5 | 25 | 20 | 40 | 30 | 16 | 12 | | | | |
| | | | | | 300-500 | 14.0 | 16.5 | 20 | 15 | 30 | 25 | 16 | 12 | | | | |
| GK-3 | 0.05-150 | 0.1-300 | 0 | 13 | 0.05-50 | 11.0 | 13.0 | 40 | 30 | 45 | 30 | 16 | 12 | 9-6 | L20 | - | 43.95 |
| | | | | | 50-150 | 11.5 | 15.0 | 35 | 20 | 40 | 20 | 16 | 12 | | | | |
| GK-5 | 10-1000 | 20-2000 | 10** | 20 | 10-600 | 13.0 | 15.0 | 20 | 10 | 26 | 20 | 15 | 10 | 9-7 | L20 | - | 67.95 |
| | | | | | 600-1000 | 14.0 | 17.0 | 20 | 15 | 25 | 20 | 25 | 15 | | | | |

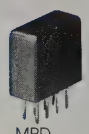
NOTES:
- ❑ Non-hermetic
- * Harmonic output below power level of F2
- ** Minimum input power +13 dBm above 700 MHz
- △ Available only with SMA connectors
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating:
  - 1a. RF input power, 200mW
  - 1b. FD-2 input is at Male BNC.

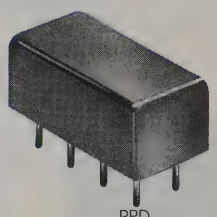
## HIGH OUTPUT 1000 mV DC output, 1 to 400 MHz

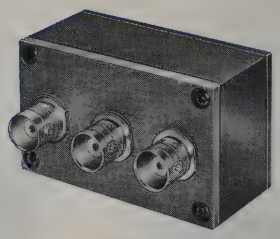
SURFACE MOUNT


SYPD

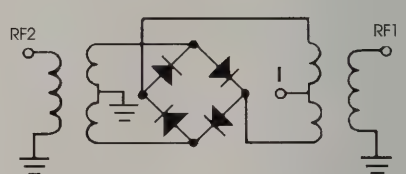

LPD


MPD


RPD


ZRPD

| MODEL NO. | FREQUENCY MHz RF1 RF2 | I | POWER IN RF1 RF2 (dBm) | SCALE FACTOR mV/degree | IMPEDANCE (ohms) OUTPUT LOAD I | ISOLATION (dB) RF1-RF2 Min. | OUTPUT POLARITY RF1/RF2 in-phase | DC OUTPUT (mV) MAX. Typ. | MAX. Min. | OFFSET Typ. | OFFSET Max. | FIGURE-OF-MERIT M Typ. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SYPD-1 | 1-100 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.2 | 1 | 143 | 12-7 | TTT167 | ec | 14.95 |
| SYPD-2 | 10-200 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.3 | 1 | 143 | 12-7 | TTT167 | ec | 18.95 |
| LPD-1 | 1-100 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.2 | 1 | 143 | 12-7 | BB48 | eb | 26.45 |
| MPD-1 | 1-100 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.2 | 1 | 143 | 12-7 | A11 | ea | 21.45 |
| MPD-2 | 10-200 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.3 | 1 | 143 | 12-8 | A11 | ea | 24.95 |
| MPD-21 | 50-400 | DC-50 | 7 | 7 | 500 | 40* | neg. | 800 | 600 | 0.5 | 1 | 120 | 12-7 | A11 | ea | 26.95 |
| RPD-1 | 1-100 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.2 | 1 | 143 | 12-7 | A01 | ea | 18.45 |
| RPD-2 | 5-150 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.3 | 1 | 143 | 12-8 | A01 | ea | 20.95 |
| ZRPD-1 | 1-100 | DC-50 | 7 | 8 | 500 | 40 | neg. | 1000 | 750 | 0.2 | 1 | 143 | 12-7 | M22 | gg | 57.95 |




**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| MPD-1 | 6625-01-294-7152 |
| MPD-21 | 5895-01-389-3572 |
| RPD-1 | 5895-01-250-8525 |

NOTES:

- ❑ Non-hermetic
- * 30 dB from 200 to 400 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating:
  1a. RF Input power, 50mW
  1b. Peak IF current, 20mA

## pin connections

see case style outline drawings for pin locations

| PORT | ea | eb | ec | gg |
|---|---|---|---|---|
| RF REF (RF2) | 8 | 8 | 2 | 1 |
| RF IN (RF1) | 1 | 5 | 1 | 3 |
| DC OUT (I) | 3,4 | 4 | 3 | 2 |
| GND EXT. | 2,5,6,7 | 1,2,3,6,7 | 4,5,6 | — |
| CASE GND | 2 | 1,2,3,6,7 | — | — |



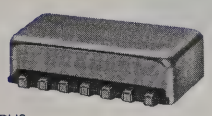
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# PHASE SHIFTER

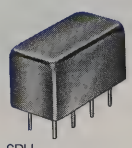
Plug-In & Surface Mount❑

## 180° VOLTAGE VARIABLE 13 to 446 MHz

SURFACE MOUNT



JSPHS



SPH

| | MODEL NO. | FREQUENCY MHz | PHASE RANGE (DEGREES) | INSERTION LOSS (dB) Typ. | INSERTION LOSS (dB) Max. | CONTROL VOLTAGE (V) | CONTROL BANDWIDTH Typ. | VSWR Typ. | VSWR Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEW | JSPHS-446 | 366-446 | 180 | 1.2 | 2.5 | 0-12 | DC-50 KHz | 1.2 | 1.7 | see below | BK276 | jb | 32.95 |
| NEW | SPH-16 | 13-16 | 180 | 1.2 | 2.5 | 0-7 | DC-50 KHz | 1.2 | 1.7 | | A01 | jh | 29.95 |

### features

- JSPHS, J-lead surface mount
- SPH, plug-in hermetically sealed
- good vswr, 20% bandwidth
- low voltage bias control, JSPHS, 10V, SPH, 7V
- low insertion loss, 1.2 dB typ.

### JSPHS-446

| CONTROL VOLTAGE (V) | PHASE SHIFT* (Deg.) 366 MHz | 406 MHz | 446 MHz | VSWR 366 MHz | 406 MHz | 446 MHz | INSERTION LOSS (dB) 366 MHz | 406 MHz | 446 MHz |
|---|---|---|---|---|---|---|---|---|---|
| 0.5 | 0.05 | 0.03 | 0.01 | 1.17 | 1.09 | 1.37 | 1.10 | 1.02 | 1.10 |
| 1 | 7.65 | 5.43 | 4.14 | 1.21 | 1.06 | 1.34 | 1.17 | 1.04 | 1.08 |
| 3 | 57.73 | 41.01 | 29.01 | 1.44 | 1.19 | 1.16 | 1.67 | 1.37 | 1.22 |
| 5 | 137.57 | 112.81 | 84.75 | 1.38 | 1.44 | 1.32 | 1.68 | 1.84 | 1.70 |
| 7 | 186.22 | 174.91 | 151.47 | 1.10 | 1.21 | 1.29 | 1.17 | 1.49 | 1.79 |
| 9 | 205.93 | 203.06 | 189.91 | 1.10 | 1.22 | 1.25 | 1.02 | 1.25 | 1.52 |
| 10 | 211.22 | 210.59 | 200.96 | 1.12 | 1.25 | 1.29 | 0.99 | 1.19 | 1.44 |

*Normalized at control voltage=0.5V

### NOTES:

❑ Non-hermetic
A. Environmental specifications and re-flow soldering information available in General Information Section.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Max. RF input power; +20 dBm
1b. Max. control voltage: 20V

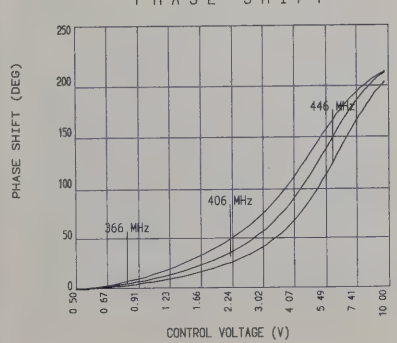
### pin connections

see case style outline drawings

| PORT | jb | jh |
|---|---|---|
| IN | 14 | 1 |
| OUT | 8 | 7 |
| BIAS | 1,7 | 4,6 |
| GND | all other pins | all other pins |

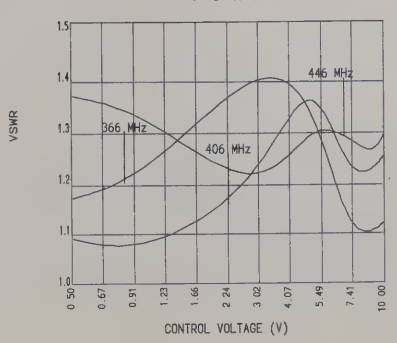
JSPHS-446

PHASE SHIFT



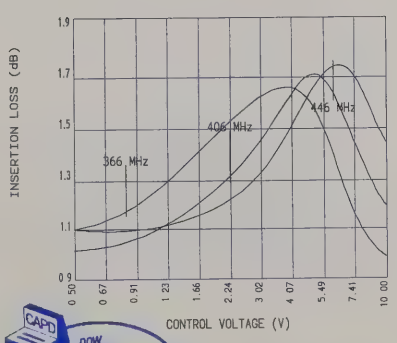

JSPHS-446

VSWR




JSPHS-446

INSERTION LOSS



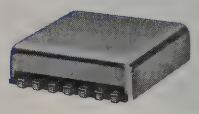

CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# BPSK 500 to 1000 MHz

SURFACE MOUNT



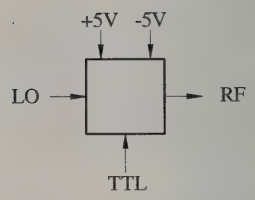
JCBM

## 180° phase shift, ttl input

| MODEL NO. | FREQUENCY (MHz) RF(signal)/ LO(carrier) $f_L$ | $f_U$ | Baseband Min. | Typ. | INSERTION LOSS (dB) Typ. | Max. | DIFF. BETWEEN STATES AMPLITUDE (dB) Typ. | Max. | PHASE (DEG.) REL. TO 180 DEG Typ. | Max. | SUPPLY CURRENT AT ± 5.0V (mA) Typ. | Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JCBM-1000DR | 500 | 1000 | DC | 80 | 2.7 | 4.0 | 0.2 | 0.6 | ±1 | ±6 | 12 | 20 | -- | BG291 | hw | 19.95 |

## features

- shielded surface mount metal case
- solder plated J-leads for excellent solderability and strain relief
- cellular applications, radar and communication systems
- small size 0.8 X 0.87 X 0.25 inch
- low insertion loss, 2.7 dB typ
- low phase shift error, ±1 degree typ
- constant amplitude, ±0.2 dB typ between states
- fast switching, 50% TTL to 90% RF 3 ns typ.




BPSK Modulator Block Diagram

## pin connections

see case style outline drawing

| PORT | hw |
|---|---|
| LO(carrier) | 8 |
| RF(signal) | 1 |
| BASEBAND | 14 |
| +5V | 12 |
| -5V | 3 |
| GND EXT. | all others |

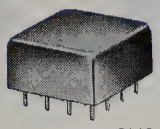
NOTES:

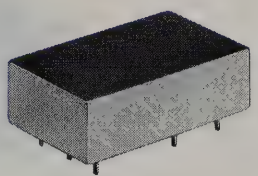
❑ Non-hermetic
1. Absolute maximum power, voltage and current rating:
   1a. LO power, 250 mW
   1b. Supply voltages ±4.8V to 5.8V; TTL < positive supply voltage
2. 1dB compression: 19 dBm typ.
3. TTL HIGH: threshold 2.0V min; current 5 mA max. at 5V
   TTL LOW: threshold 0.8V max; current (into device) 0.2 mA max

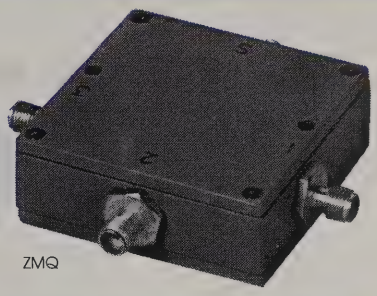


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# QPSK 30 to 1050 MHz


QMC


PMQPW
PMQ

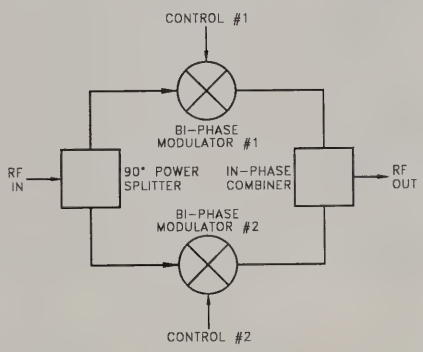

ZMQ

## wideband 360° in 90° steps

| MODEL NO. | FREQ. (MHz) | INSERTION LOSS dB Typ. | INSERTION LOSS dB Max. | AMPLITUDE UNBAL., dB Typ. | AMPLITUDE UNBAL., dB Max. | PHASE UNBAL., Deg (±) Typ. | PHASE UNBAL., Deg (±) Max. | 1 dB COMPRESSION dBm Typ. | VSWR, Typ. IN | VSWR, Typ. OUT | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QMC-100 | 50-100 | 5.6 | 7.5 | 0.2 | 0.8 | 3 | 6 | 4 | 1.5:1 | 1.9:1 | 11-17 | C07 | dq | 128.95 |
| QMC-170 | 90-170 | 5.6 | 7.5 | 0.3 | 0.8 | 3 | 6 | 4 | 1.3:1 | 1.5:1 | 11-19 | C07 | dq | 128.95 |
| QMC-1050 | 800-1050 | 5.5 | 7.5 | 0.5 | 1.0 | 3 | 7 | 4 | 2.0:1 | 2.0:1 | 11-19 | C07 | dr | 119.95 |
| PMQ-94 | 47-94 | 5.5 | 7.0 | 0.4 | 1.2 | 3 | 5 | 4 | 1.7:1 | 1.7:1 | 11-16 | AAA118 | ds | 119.95 |
| PMQ-330 | 200-330 | 5.8 | 8.0 | 0.4 | 1.5 | 3 | 6 | 4 | 1.5:1 | 1.5:1 | 11-16 | AAA118 | ds | 119.95 |
| PMQ-440 | 240-440 | 5.9 | 8.0 | 0.5 | 1.8 | 3 | 7 | 4 | 1.5:1 | 1.5:1 | 11-18 | AAA118 | ds | 119.95 |
| PMQPW-150* | 30-150 | 6.0 | 10.5 | 0.4 | 0.9 | 3 | 8 | 4 | 2:1 | 2:1 | 11-18 | AAA118 | ds | 172.95 |
| PMQPW-250* | 50-250 | 6.5 | 10.5 | 0.5 | 1.2 | 3 | 8 | 4 | 1.7:1 | 1.4:1 | 11-17 | AAA118 | ds | 172.95 |
| △ ZMQ-1050 | 800-1050 | 5.5 | 7.5 | 0.5 | 1.0 | 3 | 7 | 4 | 2.0:1 | 2.0:1 | 11-19 | HHH141 | du | 169.95 |

## features

- octave & multi-octave bandwidth
- good phase & amplitude balance
- hermetically sealed metallic enclosure with plug-in version.
- capable of meeting MIL-M-28837 requirements




## pin and coaxial connections

see case style outline drawings for pin locations

| PORT | dq | dr | ds | du |
|---|---|---|---|---|
| RF IN | 13 | 13 | 8 | 3 |
| RF OUT | 1 | 2 | 4 | 1 |
| CONTROL-1 | 5 | 4 | 2 | 4 |
| CONTROL-2 | 8 | 1 | 6 | 2 |
| NOT USED | 2 | 9,12,16 | — | — |
| GND EXT. | 3,4,6,7,9,10, 11,12,14,15,16 | 3,5,6,7,8, 10,11,14,15 | 1,3,5,7 | — |
| CASE GND | 3,4,6,7,10, 11,14,15 | 3,5,6,7,8, 10,11,14,15 | 1,3,5,7 | — |

## PHASE SHIFT VS. CONTROL CURRENT

| CONT-1 (mA) | CONT-2 (mA) | PHASE SHIFT (Deg.) |
|---|---|---|
| +20 | +20 | 0 (REF) |
| +20 | -20 | 90 |
| -20 | -20 | 180 |
| -20 | +20 | 270 |

NOTES:

* Protected under patent No. 4,673,898

△ Available only with SMA connectors

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current rating:
   1a. Input power, 100mW; 1b. Control current, 40mA
2. All specifications at control current ±20mA
3. Control ports drive with 50 ohms source

CAPD now available! computer-automated performance data

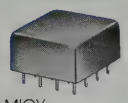
## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

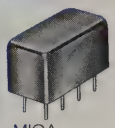
# MODULATORS

## Plug-In & Coaxial

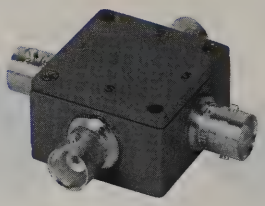
## I&Q 9 MHz to 1880 MHz



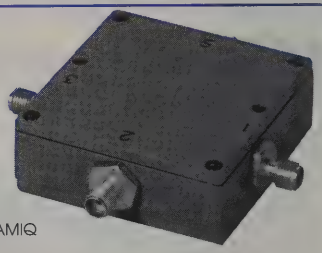
MIQY
MIQC



MIQA



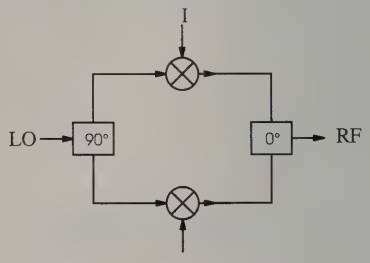
ZFMIQ



ZAMIQ

high rejection of carrier and sideband

| MODEL NO. | FREQUENCY (MHz) RF(signal)/ LO(carrier) $f_L$ | $f_U$ | I & Q Min. | Max. | CONVERSION LOSS (dB) $\bar{x}$ | σ | Max. | CARRIER REJECTION (-dBc) Typ. | Min. | SIDEBAND REJECTION (-dBc) Typ. | Min. | HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ. | Min. | 5xI/Q Typ. | Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIQA-10M | 9 | 11 | DC | 2 | 5.8 | 0.20 | 7.0 | 41 | 30 | 40 | 30 | 58 | 48 | 68 | 58 | — | A06 | dv | 49.95 |
| MIQA-21M | 20 | 23 | DC | 3 | 6.2 | 0.14 | 7.0 | 50 | 40 | 40 | 30 | 48 | 40 | 65 | 55 | — | A06 | gd | 39.95 |
| MIQA-70M | 66 | 73 | DC | 5 | 6.2 | 0.10 | 7.0 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-20 | A06 | dv | 39.95 |
| MIQA-70ML | 66 | 73 | DC | 5 | 5.7 | 0.10 | 6.5 | 38 | 30 | 38 | 30 | 48 | 43 | 58 | 55 | 11-26 | A06 | dv | 49.95 |
| MIQA-91M | 86 | 95 | DC | 5 | 5.5 | 0.10 | 6.5 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-22 | A06 | dv | 49.95 |
| MIQA-100M | 95 | 105 | DC | 5 | 5.5 | 0.10 | 6.5 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-22 | A06 | dv | 49.95 |
| MIQA-108M | 103 | 113 | DC | 5 | 5.5 | 0.10 | 6.5 | 38 | 30 | 38 | 30 | 48 | 43 | 58 | 55 | 11-23 | A06 | dv | 49.95 |
| MIQA-195M | 185 | 205 | DC | 5 | 5.6 | 0.10 | 6.5 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-23 | A06 | dv | 49.95 |
| MIQC-38M | 34 | 38 | DC | 4 | 5.6 | 0.10 | 7.0 | 48 | 38 | 37 | 30 | 54 | 40 | 65 | 55 | — | C07 | gu | 49.95 |
| MIQC-88M | 52 | 88 | DC | 5 | 5.7 | 0.10 | 7.5 | 41 | 35 | 34 | 30 | 52 | 40 | 66 | 50 | 11-20 | C07 | dx | 49.95 |
| MIQC-176M | 104 | 176 | DC | 5 | 5.5 | 0.10 | 7.0 | 38 | 30 | 36 | 30 | 47 | 35 | 70 | 50 | 11-21 | C07 | dx | 54.95 |
| MIQC-895M | 868 | 895 | DC | 5 | 8.0 | 0.10 | 10.5 | 40 | 30 | 40 | 30 | 52 | 35 | 58 | 50 | 11-21 | C07 | dw | 99.95 |
| MIQC-1785M | 1710 | 1785 | DC | 5 | 9.0 | 0.30 | 10.5 | 35 | 25 | 35 | 25 | 40 | 33 | 65 | 50 | — | C07 | dx | 99.95 |
| MIQC-1880M | 1805 | 1880 | DC | 5 | 9.0 | 0.30 | 10.5 | 35 | 25 | 35 | 25 | 40 | 33 | 65 | 50 | — | C07 | dx | 99.95 |
| △ ZAMIQ-895M | 868 | 895 | DC | 5 | 8.0 | 0.10 | 10.5 | 40 | 30 | 40 | 30 | 52 | 35 | 58 | 50 | — | HHH141 | gv | 149.95 |
| △ ZFMIQ-10M | 9 | 11 | DC | 2 | 5.8 | 0.20 | 7.0 | 41 | 30 | 40 | 30 | 58 | 45 | 68 | 58 | — | J17 | dz | 89.95 |
| △ ZFMIQ-70ML | 66 | 73 | DC | 5 | 5.7 | 0.1 | 6.5 | 38 | 30 | 38 | 30 | 48 | 43 | 58 | 55 | — | J17 | dz | 89.95 |
| △ ZFMIQ-91M | 86 | 95 | DC | 5 | 5.5 | 0.17 | 6.5 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-22 | J17 | dz | 89.95 |
| △ ZFMIQ-100M | 95 | 105 | DC | 5 | 5.5 | 0.17 | 6.5 | 38 | 30 | 38 | 30 | 48 | 45 | 58 | 55 | 11-22 | J17 | dz | 89.95 |
| △ ZFMIQ-108M | 103 | 113 | DC | 5 | 5.8 | 0.12 | 6.5 | 38 | 30 | 38 | 30 | 48 | 43 | 58 | 55 | — | J17 | dz | 89.95 |
| | | | | | | | | | | | | | | | | | | | Qty. (1-49) |
| ❑ MIQY-70M | 67 | 73 | DC | 5 | 5.8 | 0.20 | 7.0 | 40 | 35 | 36 | 30 | 47 | 40 | 60 | 50 | 11-20 | C07 | dy | 19.95 |
| ❑ MIQY-140M | 137 | 143 | DC | 5 | 5.8 | 0.20 | 7.0 | 34 | 30 | 36 | 30 | 45 | 35 | 60 | 50 | 11-26 | C07 | dy | 19.95 |



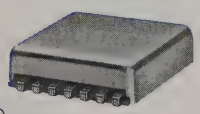

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
- σ Standard deviation
- ❑ Non-hermetic
- △ Available only with SMA connectors
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
   1a. LO power, 50mW
   1b. I&Q current, 40mA
2. Operating LO power: 10 ± 1dBm
3. 1dB compression: 0dBm typical
4. Conversion Loss = (I+Q) power, dBm - RF power, dBm
5. Carrier and sideband rejections measured at -5dBm I/Q power.
6. Q=I-90° for MIQA-70M
   Q=I+90° for all other models



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# I&Q 52 MHz to 176 MHz



JCIQ

high rejection of carrier and sideband

| MODEL NO. | FREQUENCY (MHz) RF(signal)/ LO(carrier) $f_L$ | $f_U$ | I & Q Min. | Max. | CONVERSION $\bar{x}$ | σ | Max. | CARRIER REJECTION (-dBc) Typ. | Min. | SIDEBAND REJECTION (-dBc) Typ. | Min. | HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ. | Min. | 5xI/Q Typ. | Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JCIQ-88M | 52 | 88 | DC | 5 | 5.6 | 0.1 | 7.0 | 40 | 32 | 35 | 30 | 45 | 35 | 65 | 50 | -- | BG291 | hs | 49.95 |
| JCIQ-176M | 104 | 176 | DC | 5 | 5.6 | 0.1 | 7.0 | 35 | 30 | 35 | 30 | 45 | 35 | 65 | 50 | -- | BG291 | hs | 54.95 |

## features

- shielded surface mount metal case
- solder plated J-leads for excellent solderability and strain relief
- cellular applications, radar and communication systems
- small size 0.8 X 0.87 X 0.25 inch
- good carrier and sideband rejections
- excellent 3rd and 5th order harmonic suppression
- all MIQA and MIQC models, metal case and hermetically sealed

## pin and coaxial connections

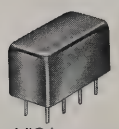
see case style outline drawings

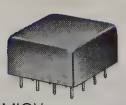
| PORT | dv | dw | dx | dy | dz | gd | gu | gv | hs |
|---|---|---|---|---|---|---|---|---|---|
| LO (carrier) | 1 | 13 | 13 | 13 | 1 | 1 | 13 | 1 | 2 |
| RF (signal) | 8 | 2 | 1 | 1 | 3 | 8 | 1 | 3 | 9 |
| I (0°)(ref.) | 7 | 4 | 8 | 8 | S | 7 | 8 | 4 | 4 |
| Q (90°)* | 4 | 1 | 5 | 5 | 2 | 4 | 5 | 2 | 11 |
| ISOLATED** | — | 9,12,16 | — | 10,11 | — | — | 10,11 | — | -- |
| 50W TERM. EXT. | 2 | — | — | — | — | — | — | — | -- |
| NOT USED | — | — | — | — | — | 2 | — | — | -- |
| GND EXT. | 3,5,6 | 3,5,6,7,8, 10,11,14,15 | 2,3,4,6,7,9,10, 11,12,14,15,16 | 2,3,4,6,7,9, 12,14,15,16 | — | 3,5,6 | 2,3,4,6,7,9, 12,14,15,16 | — | 1,3,5,6,7,8,10 12,13,14 |
| CASE GND | 3,5,6 | 3,5,6,7,8, 10,11,14,15 | 3,4,6,7,10,11, 14,15 | 2,3,4,6,7,9, 12,14,15,16 | — | 3,5,6 | 3,4,6,7, 14,15 | — | -- |

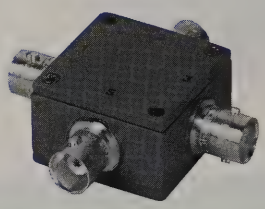
* For I&Q modulators: Q(90°) for lower sideband suppression.
** For MIQY, MIQC-38M external variable capacitors can be connected at pins 10 & 11 to ground for improvement of sideband rejection.

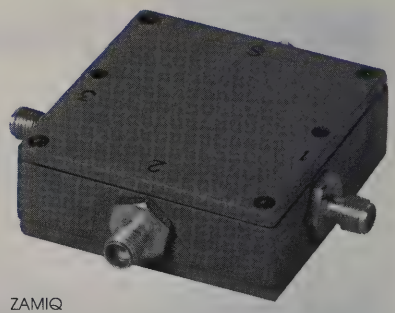
In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.

## I&Q 1.15 to 895 MHz


MIQA


MIQY
MIQC

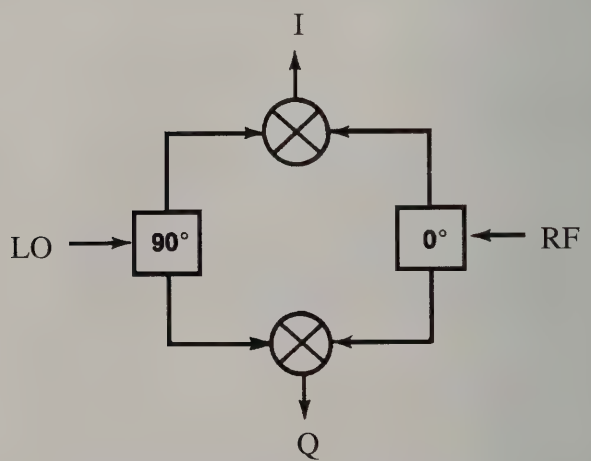

ZFMIQ


ZAMIQ

| MODEL NO. | FREQUENCY (MHz) RF(signal)/ LO(carrier) $f_L$ | $f_U$ | I & Q Min. | Max. | CONVERSION LOSS (dB) $\bar{x}$ | σ | Max. | AMPLITUDE UNBALANCE (dB) Typ. | Max. | PHASE UNBALANCE (Deg.) Typ. | Max. | HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ. | Min. | 5xI/Q Typ. | Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MIQA-10D | 9 | 11 | DC | 2 | 6.0 | 0.10 | 7.0 | 0.15 | 0.3 | 1.0 | 3.0 | 50 | 35 | 65 | 55 | 11-24 | A06 | dv | 49.95 |
| MIQA-21D | 20 | 23 | DC | 3 | 6.1 | 0.15 | 7.0 | 0.15 | 0.6 | 0.7 | 3.0 | 64 | 35 | 67 | 50 | — | A06 | gd | 49.95 |
| MIQA-70D | 66 | 73 | DC | 3 | 6.2 | 0.10 | 7.0 | 0.15 | 0.5 | 0.7 | 3.0 | 56 | 45 | 58 | 55 | — | A06 | dv | 49.95 |
| MIQC-38D | 34 | 38 | DC | 4 | 5.5 | 0.10 | 7.0 | 0.10 | 0.6 | 0.5 | 3.0 | 60 | 40 | 65 | 55 | -- | CO7 | gu | 49.95 |
| MIQC-60WD | 20 | 60 | DC | 5 | 5.3 | 0.10 | 7.0 | 0.15 | 0.6 | 1.0 | 5.0 | 55 | 45 | 67 | 55 | -- | C07 | dx | 79.95 |
| MIQC-895D | 868 | 895 | DC | 5 | 8.0 | 0.20 | 10.5 | 0.15 | 0.3 | 1.5 | 4.0 | 40 | 35 | 55 | 50 | 11-24 | C07 | dw | 99.95 |
| △ ZFMIQ-10D | 9 | 11 | DC | 2 | 6.0 | 0.10 | 7.0 | 0.15 | 0.3 | 1.0 | 3.0 | 50 | 35 | 65 | 55 | — | J17 | dz | 89.95 |
| △ ZFMIQ-70D | 66 | 73 | DC | 2 | 6.2 | 0.10 | 7.0 | 0.15 | 0.5 | 0.7 | 3.0 | 56 | 45 | 58 | 55 | — | J17 | dz | 89.95 |
| △ ZAMIQ-895D | 868 | 895 | DC | 5 | 8.0 | 0.20 | 10.5 | 0.15 | 0.3 | 1.5 | 4.0 | 52 | 35 | 58 | 50 | — | HHH141 | gv | 149.95 Qty. (1-49) |
| ❑ MIQY-1.25D | 1.15 | 1.35 | DC | 0.2 | 5.0 | 0.10 | 6.0 | 0.15 | 0.4 | 1.0 | 3.0 | 59 | 40 | 67 | 55 | — | C07 | gu | 29.95 |
| ❑ MIQY-70D | 67 | 73 | DC | 5 | 5.5 | 0.25 | 7.0 | 0.10 | 0.6 | 0.5 | 3.0 | 52 | 40 | 66 | 50 | 11-25 | C07 | dy | 19.95 |
| ❑ MIQY-140D | 137 | 143 | DC | 5 | 5.5 | 0.25 | 7.0 | 0.10 | 0.6 | 0.5 | 3.0 | 47 | 35 | 70 | 50 | 11-25 | C07 | dy | 19.95 |

NOTES:

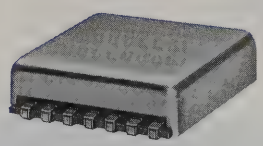
- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
- σ Standard deviation
- ❑ Non-hermetic
- △ Available only with SMA connectors
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating:
  1a. LO/RF power, 50mW.
  1b. I&Q current, 40mA
- 2. Operating LO power: 10 ± 0.5dBm
- 3. 1dB compression at +4dBm RF input
- 4. DC offset 1mV typical
- 5. Conversion Loss = RF power, dBm - (I+Q) power, dBm



I&Q Demodulation Block Diagram


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# I&Q 104 MHz to 1880 MHz



JCIQ

| MODEL NO. | FREQUENCY (MHz) RF(signal)/ LO(carrier) $f_L$ | $f_U$ | I & Q Min. | Max. | CONVERSION LOSS (dB) $\bar{x}$ | $\sigma$ | Max. | AMPLITUDE UNBALANCE (dB) Typ. | Max. | PHASE UNBALANCE (Deg.) Typ. | Max. | HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ. | Min. | 5xI/Q Typ. | Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JCIQ-176D | 104 | 176 | DC | 5 | 5.5 | 0.1 | 7.0 | 0.15 | 0.6 | 2 | 5 | 52 | 40 | 65 | 50 | --- | BG291 | hs | 54.95 |
| JCIQ-895D | 868 | 895 | DC | 5 | 8.6 | 0.1 | 10.5 | 0.2 | 0.6 | 1 | 4 | 45 | 35 | 65 | 50 | --- | BG291 | hs | 99.95 |
| JCIQ-1785D | 1710 | 1785 | DC | 5 | 8 | 0.2 | 10.5 | 0.2 | 0.6 | 2 | 5 | 50 | 35 | 65 | 50 | --- | BG291 | hs | 99.95 |
| JCIQ-1880D | 1805 | 1880 | DC | 5 | 8 | 0.2 | 10.5 | 0.2 | 0.6 | 2 | 5 | 50 | 35 | 65 | 50 | --- | BG291 | hs | 99.95 |

## features

- shielded surface mount metal case
- solder plated J-leads for excellent solderability and strain relief
- cellular applications, radar and communication systems
- good amplitude and phase unbalance
- excellent 3rd and 5th order harmonic suppression
- small size 0.8 X 0.87 X 0.25 inch

## pin and coaxial connections

see case style outline drawings

| PORT | dv | dw | dx | dy | dz | gd | gu | gv | hs |
|---|---|---|---|---|---|---|---|---|---|
| LO (carrier) | 1 | 13 | 13 | 13 | 1 | 1 | 13 | 1 | 2 |
| RF (signal) | 8 | 2 | 1 | 1 | 3 | 8 | 1 | 3 | 9 |
| I (0°)(ref.) | 7 | 4 | 8 | 8 | S | 7 | 8 | 4 | 4 |
| Q (90°)* | 4 | 1 | 5 | 5 | 2 | 4 | 5 | 2 | 11 |
| ISOLATED** | — | 9,12,16 | — | 10,11 | — | — | 10,11 | — | — |
| 50W TERM. EXT. | 2 | — | — | — | — | — | — | — | — |
| NOT USED | — | — | — | — | — | 2 | — | — | — |
| GND EXT. | 3,5,6 | 3,5,6,7,8, 10,11,14,15 | 2,3,4,6,7,9,10, 11,12,14,15,16 | 2,3,4,6,7,9, 12,14,15,16 | — | 3,5,6 | 2,3,4,6,7,9, 12,14,15,16 | — | 1,3,5,6,7,8,10 12,13,14 |
| CASE GND | 3,5,6 | 3,5,6,7,8, 10,11,14,15 | 3,4,6,7,10,11, 14,15 | 2,3,4,6,7,9, 12,14,15,16 | — | 3,5,6 | 3,4,6,7, 14,15 | — | — |

For I&Q demodulators:

Models MIQA-70D and ZFMIQ-70D: Q= +90° for LO>RF
Q= -90° for LO<RF

All other models: Q=+90° for LO<RF
Q=-90° for LO>RF

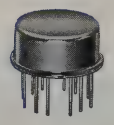
** For MIQY, MIQC-38D, external variable capacitors can be connected at pins 10 & 11 to ground for improvement of phase unbalance.

In Stock... Immediate Delivery

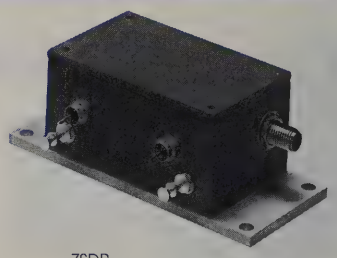
For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

## SPDT/SP4T TTL Drivers 10 to 3000 MHz



TOSW



ZSDR

| MODEL NO. | TYPE | FREQUENCY MHz $f_L - f_U$ | INSERTION LOSS dB low-band lw Typ. | lw Max. | upper band U Typ. | U Max. | IN-OUT ISOLATION, dB frequency band L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOSW-230 | SPDT | 10-3000 | 1.3 | 1.9 | 1.8 | 2.7 | 60 | 40 | 40 | 28 | 35 | 22 | 13-12 | QQ96 | ee | 49.95 |
| TOSW-425 | SP4T | 10-2500 | 1.1 | 1.7 | 1.5 | 2.5 | 60 | 40 | 40 | 30 | 35 | 22 | 13-12 | QQ96 | ed | 69.95 |
| Δ ZSDR-230 | SPDT | 10-3000 | 1.3 | 1.9 | 1.8 | 2.7 | 60 | 40 | 40 | 28 | 35 | 22 | 13-12 | CCC127 | - | 89.95 |
| Δ ZSDR-425 | SP4T | 10-2500 | 1.1 | 1.7 | 1.5 | 2.5 | 60 | 40 | 40 | 30 | 35 | 22 | 13-12 | GGG126 | - | 109.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)

lw = low band ($f_L$ to $f_U$/2)

U = upper range ($f_U$/2 to $f_U$)

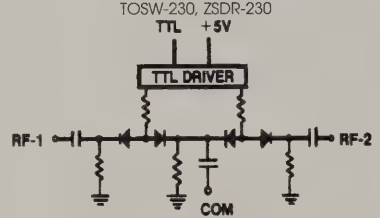
### ADDITIONAL SPECIFICATIONS

VSWR ("ON" STATE): 1.3 TYP., 1.9 MAX.
SWITCHING TIME (μSEC): 2.0 TYP., 4.0 MAX.
SUPPLIED VOLTAGE: +5V

TTL INPUT HIGH THRESHOLD 2 VOLTS MIN.
TTL INPUT LOW THRESHOLD 0.8 VOLTS MAX.

### control logic

TOSW-230, ZSDR-230

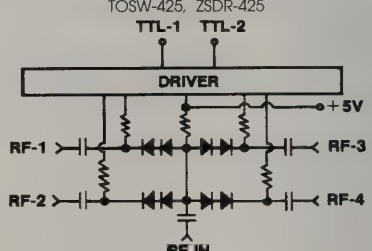



TTL LOGIC

| | | |
|---|---|---|
| TTL 1: | RF-1/OFF | RF-2/ON |
| TTL 0: | RF-1/ON | RF-2/OFF |

### control logic

TOSW-425, ZSDR-425




TTL LOGIC

| | TTL-1 | TTL-2 |
|---|---|---|
| RF-1 | 1 | 0 |
| RF-2 | 1 | 1 |
| RF-3 | 0 | 1 |
| RF-4 | 0 | 0 |

NOTES:

** Video leakage or break through is defined as leakage of TTL switching signal to RF output ports.
Δ Available only with SMA connectors.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum RF power and control current

| Models (all) | Power, dBm L | M | U | Control Current (mA) |
|---|---|---|---|---|
| TOSW | +20 | +28 | +30 | 10 |
| ZSDR | +20 | +28 | +30 | 10 |
| PSW | +20 | +20 | +20 | 5 |
| ZMSW | +20 | +20 | +20 | 5 |

2. 1 dB Compression point: all models

| Frequency, MHz | RF Power, dBm |
|---|---|
| 10 to 100 | +6 increase to +19 dBm |
| above 100 | +19 min. |

### pin and coaxial connections

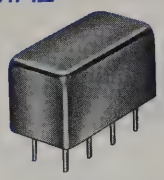
see case style outline drawings

| PORT | ed | ee |
|---|---|---|
| RF IN | 8 | 8 |
| RF OUT 1 | 4 | 5 |
| RF OUT 2 | 6 | 11 |
| RF OUT 3 | 10 | — |
| RF OUT 4 | 12 | — |
| TTL-1 | 2 | 3 |
| TTL-2 | 3 | — |
| +5V | 1 | 1 |
| -5V | — | — |
| GND EXT. | 5,7,9,11 | 2,4,6,7,9, 10,12 |
| CASE GND | 5,7,9,11 | 2,4,6,7,9, 10,12 |

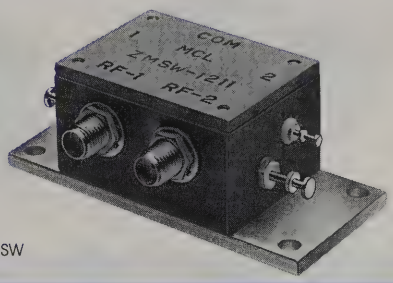


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# SPST/SPDT 10 to 2500 MHz



PSW




ZMSW

| MODEL NO. | TYPE | FREQUENCY MHz $f_L$ - $f_U$ | INSERTION LOSS dB low-band lw Typ. | lw Max. | upper band U Typ. | U Max. | IN-OUT ISOLATION, dB frequency band L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PSW-1211 | SPDT | 10-2500 | 1.1 | 1.7 | 1.7 | 2.7 | 50 | 40 | 35 | 30 | 28 | 22 | 13-13 | A06 | ep | 32.95 |
| ZMSW-1111 | SPST | 10-2500 | 1.1 | 1.7 | 1.7 | 2.7 | 50 | 45 | 35 | 30 | 28 | 22 | 13-13 | JJ77 | eq | 69.95 |
| ZMSW-1211 | SPDT | 10-2500 | 1.1 | 1.7 | 1.7 | 2.7 | 50 | 45 | 35 | 30 | 28 | 22 | 13-13 | JJ77 | er | 69.95 |

L = low range ($f_L$ to 10 $f_L$)

M = mid range (10 $f_L$ to $f_U$/2)
lw = low band ($f_L$ to $f_U$/2)

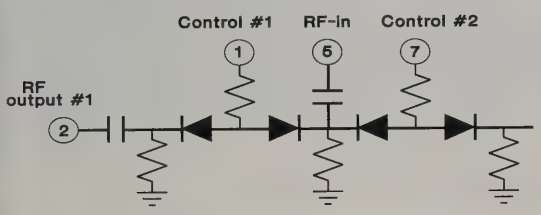
U = upper range ($f_U$/2 to $f_U$)

## ADDITIONAL SPECIFICATIONS:

VSWR 1.6 max. ("on" state)
Switching time: 4μ sec. max.
Rise time: 2μ sec typical
Control voltage +5V on condition, 0V off condition
1 dB compression for all pin diode switches from 10 to 100 MHz increase from 6 to 19 dBm. Above 100 MHz, 19 dBm min.

## control logic

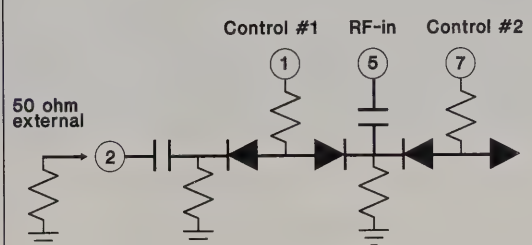
PSW-1211, ZMSW-12111




| | LOGIC Control #1 (pin 1) | Control#2 (pin 7) | RF 2 (pin 8) | RF 1 (pin 2) |
|---|---|---|---|---|
| State 1: | 0V | +5V | ON | OFF |
| State 2: | +5V | 0V | OFF | ON |

## control logic

PSW-1211 as absorptive SPST




| | LOGIC Control #1 (pin 1) | Control#2 (pin 7) | RF 2 (pin 8) |
|---|---|---|---|
| State 1: | 0V | +5V | ON |
| State 2: | +5V | 0V | OFF(50Ω) |

## pin and coaxial connections

see case style outline drawings

| PORT | ep(SPST) | ep(SPDT) | eq | er |
|---|---|---|---|---|
| RF IN | 5 | 5 | com | com |
| RF OUT 1 | 8 | 2 | — | RF-1 |
| RF OUT 2 | — | 8 | RF-1 | RF-2 |
| CONTROL 1 | 1 | 1 | — | 1 |
| CONTROL 2 | 7 | 7 | 2 | 2 |
| 50-OHM TERM. | 2 | — | 1 | — |
| GND EXT. | 3,4,6 | 3,4,6 | — | — |
| CASE GND | 3,6 | 3,6 | — | — |

## NSN GUIDE

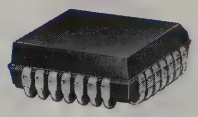
| MCL NO. | NSN |
|---|---|
| PSW-1211 | 5985-01-328-8006 |

CAPD now available! computer-automated performance data

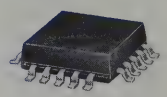
## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# SPDT/SP4T WITH TTL Drivers DC to 5 GHz



GSWA



YSWA
YSW

| MODEL NO. | FREQ. GHz | ABSORPTIVE | REFLECTIVE | INSERTION LOSS, dB FREQUENCY BAND A Typ. | A Max. | B Typ. | B Max. | C★ Typ. | C★ Max. | 1dB COMPRESSION, dBm FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C★ Typ. | C★ Min. | ✪IN-OUT ISOLATION, dB FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C★ Typ. | C★ Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GSWA-4-30DR | DC-3 | ● | | 1.25 | 1.8 | 2.0 | 3.0 | 2.75 | 3.9 | 22 | — | 28 | — | 28 | — | 50 | 40 | 37 | 32 | 31 | 26 | — | AN213 | hb | 19.95 |
| YSW-2-50DR | DC-5 | | ● | 0.9 | 1.5 | 1.3 | 1.7 | 1.4 | 2.1 | 20 | 15 | 20 | 19 | 24.0 | 20 | 50 | 41 | 40 | 32 | 28 | 22 | 13-14 | KKK155 | ef | 16.95 |
| YSWA-2-50DR | DC-5 | ● | | 1.1 | 1.5 | 1.4 | 1.9 | 1.9 | 2.7 | 18 | 13 | 20 | 17 | 22.5 | 20 | 42 | 38 | 31 | 27 | 20 | 19 | 13-14 | KKK155 | ef | 23.95 |

A = DC to 500MHz B = 500MHz to 2000MHz C = 2000MHz to 5000MHz

## features

- excellent repeatability, specification limits 4.5σ typical from mean.
- high isolation, 80 dB typical at 5 MHz.
- low video break thru, 30 mVP-P typical.
- very fast switching, 3 nsec typical (SPDT).
- low DC power consumption, 120mW typical.

## pin and coaxial connections

see case style outline drawings for pin locations

| PORT | ef | eg | ej | em | hb |
|---|---|---|---|---|---|
| RF IN | 4 | 3 | 5 | 1 | 1 |
| RF OUT 1 | 12 | 2 | 3 | 2 | 25 |
| RF OUT 2 | 14 | 1 | 2 | — | 21 |
| RF OUT 3 | — | — | — | — | 9 |
| RF OUT 4 | — | — | — | — | 5 |
| CONTROL 1 | 2 | — | 4 | 5 | 15,16,13,14 |
| CONTROL 2 | — | — | 1 | 3 | — |
| TTL-1 | | 4 | | | |
| TTL-2 | | — | | | |
| +5V | 19 | +5 VDC | | | 12 |
| -5V | 7 | -5 VDC | | | 18 |
| NOT USED | 9,17 | | | | — |
| GND EXT. | all other pins | | | | all other pins |

## control logic, all models

| Model Series | Control Ports 1 | 2 | 3 | 4 | RF outputs 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| GSWA | Low | High | High | High | On | Off | Off | Off |
| | High | Low | High | High | Off | On | Off | Off |
| | High | High | Low | High | Off | Off | On | Off |
| | High | High | High | Low | Off | Off | Off | On |
| YSW, YSWA | High | — | — | — | Off | On | — | — |
| ZFSW, ZFSWA | -v | 0 | — | — | On | Off | — | — |
| | 0 | -v | — | — | Off | On | — | — |
| ZFSWHA | -v | 0 | — | — | On | — | — | — |
| | 0 | -v | — | — | Off | — | — | — |
| ZYSW, ZYSWA | Low | — | — | — | On | Off | — | — |
| | High | — | — | — | Off | On | — | — |

NOTES:

** Video leakage or break through is defined as leakage of TTL switching signal to RF output ports.

✪ Typical isolation YSW/A at 5 MHz is 80 dB and decreases 5 dB/octave from 5-1000 MHz.

★ For GSWA-4-30DR, frequency band C=2GHz to 3 GHz.
Moisture Resistance of models on this page is not guaranteed.

❑ Non-hermetic

△ Available with SMA connectors

A. Environmental specifications and re-flow soldering information available in General Information Section.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute maximum RF power ratings.

| Models | Power, dBm DC-100 | 100-500 | 500-2000 | 2000-3000 | 3000-5000 |
|---|---|---|---|---|---|
| GSWA-4-30DR | | | | | |
| Steady state control: | +20 | +24 | +30 | +30 | — |
| As modulator: | +8 | +14 | +20 | +20 | — |
| YSW-2-50DR | +22 | +22 | +22 | +24 | +24 |
| YSWA-2-50DR | +20 | +20 | +20 | +20 | +20 |
| ZFSW-2-46 | +24 | +27 | +30 | +30 | +30 |
| ZFSWA-2-46 | +24 | +24 | +27 | +27 | +27 |
| ZYSWA-2-50DR | +22 | +22 | +22 | +24 | +24 |
| ZYSWA-2-50DR | +20 | +20 | +20 | +20 | +20 |
| ZFSWHA-120 | | | | | |
| Steady state control: | +23 | +30 | +33 | — | — |
| As modulator: | +14.5 | +20 | +27 | — | — |

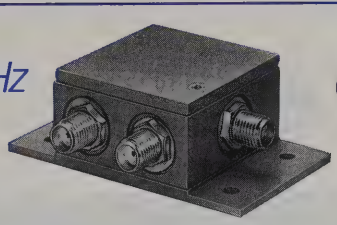
* In modulator service, unrestricted switching is permitted with RF applied

2. For reflective switches YSW, ZYSW-2-50DR, ZFSWHA-1-20 models, OFF state of RF output is low impedance.

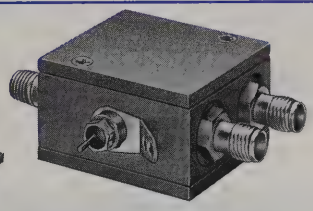


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## SPDT With/ Without TTL Drivers DC to 5 GHz



ZFSWA
ZFSW

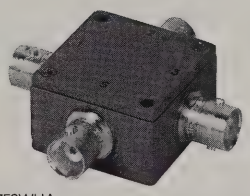


ZYSWA
ZYSW

| MODEL NO. | FREQ. GHz | ABSORPTIVE | REFLECTIVE | INSERTION LOSS, dB FREQUENCY BAND A Typ. | A Max. | B Typ. | B Max. | C Typ. | C Max. | 1dB COMPRESSION, dBm FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C Typ. | C Min. | ❂IN-OUT ISOLATION, dB FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C Typ. | C Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZFSW-2-46 | DC-4.6 | | ● | 0.9 | 1.1 | 1.0 | 1.3 | 1.3 | 1.7 | 10 | — | 17 | — | 27 | — | 60 | 50 | 45 | 40 | 30 | 23 | 13-15 | G144 | ej | 79.95 |
| ZFSWA-2-46 | DC-4.6 | ● | | 0.8 | 1.1 | 0.9 | 1.3 | 1.5 | 2.6 | 10 | — | 17 | — | 27 | — | 60 | 45 | 50 | 40 | 30 | 25 | 13-15 | G144 | ej | 89.95 |
| ZYSW-2-50DR | DC-5 | | ● | 0.9 | 1.5 | 1.3 | 1.7 | 1.4 | 2.1 | 20 | 15 | 20 | 19 | 24.0 | 20 | 50 | 41 | 40 | 32 | 28 | 22 | 13-14 | ZZ121 | eg | 59.95 |
| ZYSWA-2-50DR | DC-5 | ● | | 1.1 | 1.5 | 1.4 | 1.9 | 1.9 | 2.7 | 18 | 13 | 20 | 17 | 22.5 | 20 | 42 | 38 | 31 | 27 | 20 | 19 | 13-14 | ZZ121 | eg | 69.95 |

ZFSW, ZFSWA: A = DC to 200MHz B = 200MHz to 1000MHz C = 1000MHz to 4600MHz
ZYSW, ZYSWA: A = DC to 500MHz B = 500MHz to 2000MHz C = 2000MHz to 5000MHz

## SPST High Isolation DC to 2 GHz



ZFSWHA

| MODEL NO. | FREQ. GHz | ABSORPTIVE | INSERTION LOSS, dB FREQUENCY BAND A Typ. | A Max. | B Typ. | B Max. | 1dB COMPRESSION, dBm FREQUENCY BAND A Typ. | B Typ. | IN-OUT ISOLATION, dB FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ZFSWHA-1-20 | DC-2.0 | ● | 0.8 | 1.2 | 1.3 | 1.7 | 19 | 26 | 75 | 60 | 65 | 58 | 13-11 | J17 | em | 74.95 |

A = DC to 200MHz B = 200MHz to 2000MHz

### additional specifications, all models

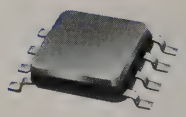
| Model Series | ZFSW, ZFSWA | ZFSWHA | ZYSW, ZYSWA | GSWA | YSW, YSWA |
|---|---|---|---|---|---|
| Control Voltage<br>Low Threshold, max.<br>High Threshold, min. | -8/0 for compression spec, -8 to -5/0 for all other specs | | 0/5.5, max.<br>0.8<br>2.0 | 0/ 5.5<br>0.8<br>3.5 | 0/ 5.5<br>0.8<br>2.0 |
| Control Current, mA | 2.5 typ. at -8V | 0.2 max to -8V | High V: 2 typ., 5 max.<br>Low V:0.2 max. | High V: 0.2 max<br>Low V: 0.02 max | High V: 2 typ., 5 max.<br>Low V: 0.2 max. |
| Positive Supply V. | none | none | 5±0.5 | +5±0.5 | +5±0.5 |
| Negative Supply V. | none | none | -5±0.5 | -5±0.25 | -5±0.5 |
| VSWR | 1.3 typ. | DC-0.2GHz / 0.2-2GHz<br>ON, all ports 1.25 max / 1.5 max<br>OFF, Input 1.25 max. / 1.5 max.<br>OFF, Output 1.4 max. / 1.5 max. | 1.4 typ., 2.0 max. | 1.28 typ., ON<br>1.24 typ., OFF<br>DC-2GHz | 1.4 typ., 2.0 max. |
| Rise/ Fall time (10% - 90%), ns<br>Switching time, 50% of Control to<br>90% RF (Turn-on), ns<br>10% RF (Turn-off), ns | 2 typ. | 3 typ., 5 max.<br><br>7 typ., 10 max.<br>3 typ., 10 max. | 1.5 typ., 3 max.<br><br>3 typ., 5 max. | 25 typ.<br><br>45 typ. | 1.5 typ., 3 max.<br><br>3 typ., 5 max. |
| **Video Leakage, mVp-p<br>0/-5V Control | 30 typ. | 30 typ., 50 max. | 30 typ. | 30 typ. | 30 typ. |
| Temperature, °C | operating<br>storage | -55 to 100<br>-55 to 150 | -55 to 85<br>-55 to 100 | -30 to 85<br>-55 to 100 | -55 to 85<br>-55 to 100 |
| MTBF, hrs @85°C case | | | | $30X10^6$ | $30X10^6$ |

CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

## SPDT DC to 4.6 GHz



KSW
*KSWA
*KSWHA

| MODEL NO. | FREQ. GHz | ABSORPTIVE | REFLECTIVE | INSERTION LOSS, dB FREQUENCY BAND A Typ. | A Max. | B Typ. | B Max. | C Typ. | C Max. | 1dB COMPRESSION, dBm FREQUENCY BAND A Typ. | B Typ. | C Typ. | IN-OUT ISOLATION, dB FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C Typ. | C Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KSW-2-46 | DC-4.6 | | ● | 0.9 | 1.1 | 1.0 | 1.3 | 1.3 | 1.7 | 10 | 17 | 27 | 60 | 50 | 45 | 40 | 30 | 23 | 13-15 | XX112 | eh | 36.95 |
| * KSWA-2-46 | DC-4.6 | ● | | 0.8 | 1.1 | 0.9 | 1.3 | 1.5 | 2.6 | 10 | 17 | 27 | 60 | 45 | 50 | 40 | 30 | 25 | 13-15 | XX112 | eh | 58.95 |

A = DC to 200MHz  B = 200MHz to 1000MHz  C = 1000MHz to 4600MHz

## SPST DC to 2 GHz High Isolation

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * KSWHA-1-20 | DC-2.0 | ● | | 0.8 | 1.2 | 1.3 | 1.7 | — | — | 19 | 26 | — | 75 | 60 | 65 | 58 | — | — | 13-11 | XX112 | ek | 34.95 |

A = DC to 200MHz  B = 200MHz to 2000MHz

## additional specifications

| Model Series | KSW | KSWA | KSWHA | | | MSW | MSWA | MSWT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control Voltage | -8/0 for compression spec, -8 to -5/0 for all other specs | | | | | | | | | | | |
| Control Current, mA | 2.5 typ. at -8V | | 0.2 max to -8V | | | 0.2 max to -8V, 0.02 max at 0 to -0.2V | | | | | | |
| | | | | DC-0.2GHz | 0.2-2GHz | DC-1GHz | 1-2GHz | DC-0.1GHz | 0.1-0.5GHz | 0.5-1GHz | 1-2GHz | |
| VSWR | 1.3 typ. | | ON, all ports | 1.25 max | 1.5 max | 1.2 typ. | 1.4 typ. | 1.2 | 1.25 | 1.4 | 1.4 | typ. |
| | | | OFF, Input | 1.25 max. | 1.5 max. | | | 1.45 | 1.65 | 1.8 | 1.9 | max. |
| | | | OFF, Output | 1.4 max. | 1.5 max. | | | | | | | |
| Rise/ Fall time (10% - 90%), ns | 2 typ. | | 3 typ., 5 max. | | | 2 typ. | 3 typ. | 2 typ. | | | | |
| Switching time, 50% of Control to | | | | | | | | | | | | |
| 90% RF (Turn-on), ns | | | 7 typ., 10 max. | | | 4 typ. | 5.5 typ. | 4 typ. | | | | |
| 10% RF (Turn-off), ns | | | 3 typ., 10 max. | | | 4 typ. | 3 typ. | 4 typ. | | | | |
| **Video Leakage, mVp-p | 30 typ. | | 30 typ., 50 max. | | | 15 typ. | 8 typ. | 15 typ. | | | | |
| 0/-5V Control | | | | | | | | | | | | |
| Temperature, °C operating | -55 to 100 | | | | | -40 to 85 | | | | | | |
| storage | -55 to 150 | | | | | -55 to 100 | | | | | | |
| MTBF, hrs @100°C case | 7X10⁶ | | 11X10⁶ | | | | | | | | | |

NOTES:

* KSWA and KSWHA models are hermetically sealed.

** Video leakage or break through is defined as leakage of TTL switching signal to RF output ports.

A. Environmental specifications and re-flow soldering information available in General Information Section.

B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings for KSW, KSWA models:
   1a. RF power input, +30 dBm except below 500 MHz +27 dBm;
   1b. Control voltage -10 V maximum.

2. Absolute maximum power, voltage & current ratings: MSW, MSWA MSWT models:

| 2a. RF power input, (25°C) | | DC-100 | 100-500 | 500-2000 | MHz |
|---|---|---|---|---|---|
| MSW-2-20: | Steady state 0/-8V control, | +23 | +27 | +31 | dBm |
| | As modulator | +11 | +17 | +21 | dBm |
| MSWA-2-20: | Steady state 0/-8V control, | +24 | +27 | +33 | dBm |
| | As modulator | +12 | +17 | +23 | dBm |
| MSWT-4-20: | Steady state 0/-8V control | +24 | +27 | +33 | dBm |
| | modulator application | +12 | +17 | +23 | dBm |

2b. Control current, 500µA (Occurs at -9V to -12V typical)

3. Absolute maximum power, voltage and current ratings for KSWHA-1-20:

3a. RF power input, (Above 20°C derate power linearly to zero at 150°C.)

| | DC-20 | 20-500 | 500-2000 | MHz |
|---|---|---|---|---|
| Steady state 0/-8V control, | +23 | +30 | +33 | dBm |
| As modulator * | +14.5 | +20 | +27 | dBm |

* In modulator service, unrestricted switching is permitted with RF applied

3b. Control current, 500µA (Occurs at -9V to -12V typical)

4. For reflective switches, KSW, MSW models, OFF state of RF output is low impedance.

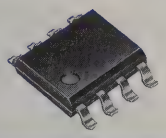
**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| KSW-2-46 | 5985-01-393-7219 |
| KSWA-2-46 | 5985-01-369-4224 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## SPDT DC to 2 GHz



MSW
MSWA
MSWT

| MODEL NO. | FREQ. GHz | ABSORPTIVE | REFLECTIVE | INSERTION LOSS, dB FREQUENCY BAND A Typ. | A Max. | B Typ. | B Max. | C Typ. | C Max. | D Typ. | D Max. | 1dB COMPRESSION, dBm FREQUENCY BAND A Typ. | B Typ. | C Typ. | D Typ. | IN-OUT ISOLATION, dB FREQUENCY BAND A Typ. | A Min. | B Typ. | B Min. | C Typ. | C Min. | D Typ. | D Min. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MSW-2-20 | DC-2.0 | | ● | 0.30 | 0.6 | 0.4 | 0.7 | 0.50 | 1.0 | 0.75 | 1.3 | 22 | 23 | 24 | 25 | 55 | 50 | 43 | 36 | 34 | 28 | 24 | 20 | — | XX211 | et | 2.95 |
| MSWA-2-20 | DC-2.0 | ● | | 0.65 | 0.9 | 0.9 | 1.2 | 0.95 | 1.3 | 1.20 | 1.5 | 20 | 24 | 27 | 29 | 60 | 50 | 45 | 37 | 40 | 32 | 30 | 25 | — | XX211 | es | 3.45 |

A=DC to 100MHz B=100MHz to 500MHz C=500MHz to 1000MHz D=1000MHz to 2000MHz

## TRANSFER DC to 2 GHz Low Video Leakage

| | | path | | | | | | | | | | | | ISOLATION, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MSWT-4-20 | DC-2.0 | Tx-J1/J2 | 0.9 | 1.2 | 1.1 | 1.5 | 1.25 | 1.8 | 1.45 | 2.2 | 18 | 25 | 28 | 29 | 51 | 44 | 34 | 27 | 26 | 21 | 19 | 15 | — | XX211 | eu | 3.95 |
| | | J1/J2-Rx | 1.1 | 1.4 | 1.3 | 1.7 | 1.5 | 2.0 | 1.6 | 2.2 | 16 | 18 | 20 | 22 | 52 | 46 | 37 | 31 | 29 | 24 | 21 | 17 | | | | |
| | | Tx-Rx | | | | | | | | | | | | | 60 | 53 | 41 | 36 | 34 | 27 | 28 | 21 | | | | |

A=DC to 100MHz B=100MHz to 500MHz C=500MHz to 1000MHz D=1000MHz to 2000MHz

### control logic

| Model Series | Control Ports 1 | 2 | 3 | 4 | RF outputs 1 | 2 |
|---|---|---|---|---|---|---|
| KSW, KSWA | -v | 0 | — | — | On | Off |
| MSW, MSWA | 0 | -v | — | — | Off | On |
| KSWHA | -v | 0 | — | — | On | — |
| | 0 | -v | — | — | Off | — |
| MSWT | | | | | "On" Path (other paths are "OFF") | |
| | 0 | -v | -v | -v | Tx-J2 | |
| | -v | 0 | -v | -v | Tx-J1 | |
| | -v | -v | 0 | -v | Rx-J1 | |
| | -v | -v | -v | 0 | Rx-J2 | |
| | 0 | -v | 0 | -v | Tx-J2 & Rx-J1 | |
| | -v | 0 | -v | 0 | Tx-J1 & Rx-J2 | |

### pin connections

see case style outline drawings

| PORT | eh | ek | es | et |
|---|---|---|---|---|
| RF IN | 2 | 1 | 2 | 1 |
| RF OUT 1 | 5 | 5 | 8 | 6 |
| RF OUT 2 | 8 | | 5 | 3 |
| CONTROL 1 | 3 | 2 | 3 | 5 |
| CONTROL 2 | 1 | 3 | 1 | 4 |
| GND EXT. | 4,6,7 | 4,6,7,8 | 4,6,7 | 2,7,8 |

| PORT | eu |
|---|---|
| Tx | 2 |
| Rx | 6 |
| J1 | 4 |
| J2 | 8 |
| CONTROL 1 | 1 |
| CONTROL 2 | 3 |
| CONTROL 3 | 5 |
| CONTROL 4 | 7 |

## Application Note for Model MSWT-4-20 Transmit-Receive Switch:

The functional schematic diagram for a diversity application of the switch is shown in Figure 1, with the required external components including 4 independent drivers at the control ports. When operation as a transfer switch is desired only 2 drivers are needed, one connected to the V1 and V3 ports together, and the other connected to the V2 and V4 ports. In either case, two DC return paths are needed for the control voltages, represented by the ground symbols in the diagram. These returns must be via oppositely situated RF ports (Tx and Rx or J1 and J2), and can be furnished incidentally by the user's RF terminating devices themselves. However, if those devices are AC-coupled (that is, they contain DC blocking capacitors), then the shunt resistors shown in the diagram are needed. The resistors should be installed either at the Tx and Rx ports (connection shown as solid), or at J1 and J2 (shown dotted), with equal effect. If one external RF device has a DC return to ground, for example, then only one resistor is needed; it must be installed at the opposite RF port of the switch. The resistance of each of the external DC returns should be 20K ohms or less, for proper ON/OFF FETs.

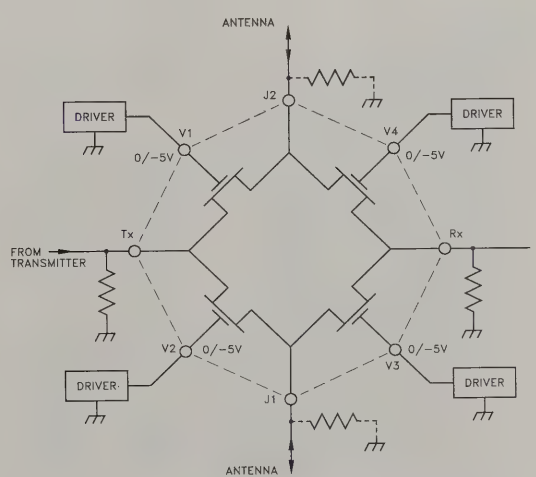
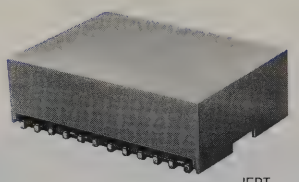



Figure 1. FUNCTIONAL SCHEMATIC DIAGRAM (Transmit-Receive application)

In Stock... Immediate Delivery
For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

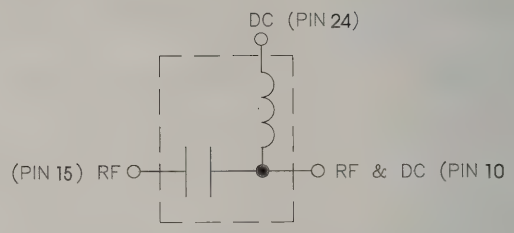
## HIGH CURRENT 100 kHz to 6000 MHz



JEBT

| MODEL NO. | FREQ. RANGE MHz $f_L$-$f_U$ | INSERTION LOSS*, dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | ISOLATION*, dB (RF-DC, RF&DC-DC) L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JEBT-4R2G | 10-4200 | 0.15 | 0.6 | 0.6 | 1.2 | 0.6 | 1.6 | 32 | 20 | 40 | 20 | 40 | 20 | BL301 | hr | 39.95 |
| JEBT-6G | 10-6000 | 0.15 | 0.6 | 0.7 | 1.4 | 1.3 | 2.9 | 32 | 20 | 40 | 20 | 40 | 17 | BL301 | hr | 59.95 |
| JEBT-4R2GW | 0.1-4200 | 0.15 | 0.8 | 0.6 | 1.2 | 0.6 | 1.6 | 25 | 15 | 40 | 20 | 40 | 20 | BL301 | hr | 59.95 |
| JEBT-6GW | 0.1-6000 | 0.15 | 0.8 | 0.7 | 1.4 | 1.3 | 2.9 | 25 | 15 | 40 | 20 | 30 | 17 | BL301 | hr | 69.95 |

L = low range ($f_L$ to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to $f_U$)




### features

- wide band coverage 0.1 to 6000 MHz
- low insertion loss 0.6 dB typ.
- good isolation 40dB typ.
- small size (JEBT) 1.26 X 0.94 X 0.39 inch
- feedthrough version (FT) available for coaxial models

### applications

- biasing amplifiers
- biasing of laser diodes
- DC return
- DC blocking
- good for digital & analog applications.

NOTES:

❑ Non-hermetic
✪ When only specification for M range given, specification applies to entire frequency range.
* Insertion loss and isolation are guaranteed up to 20 dBm-RF power and 200 mA DC current.
** VSWR measured with open and short at DC port.
✣ Insertion loss 1 dB Max. and isolation 7 dB Min. 0.1 to 0.3 MHz.
▼ Connectors: SMA-F at "RF", and SMA-M at "RF & DC" port. For DC port, ZFBT available with SMA-F and for ZFBT-FT available with feedthrough terminal.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. max. input current: 500 mA
   1b. max. RF power: 30 dBm
   1c. max. voltage at DC port: 30V; JEBT series, 25V.
2. DC resistance from DC to RF & DC port: 4.5 ohm typical.

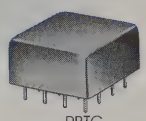
### pin & coaxial connections

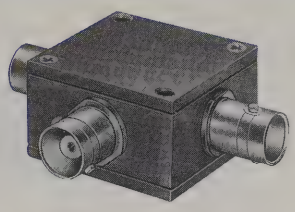
| PORT | gf | hf | hh | hr |
|---|---|---|---|---|
| RF | 1 | in | 9 | 15 |
| RF & DC | 2 | out | 12 | 10 |
| DC | 3 | +15 | 3 | 24 |
| GND | -- | — | all other pins | all other pins |

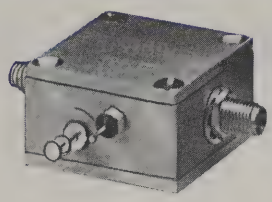


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# WIDEBAND 0.1 to 6000 MHz

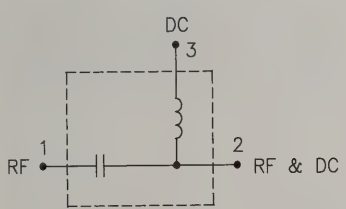

PBTC


ZFBT


ZFBT-FT

| MODEL NO. | FREQ. MHz $f_L$-$f_U$ | INSERTION LOSS*, dB L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | ISOLATION*, dB (RF port to DC port) (RF&DC port to DC port) L Typ. | L Min. | M Typ. | M Min. | U Typ. | U Min. | VSWR** (:1) L Typ. | L Max. | M Typ. | M Max. | U Typ. | U Max. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE ▼ Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PBTC-1G | 10-1000 | 0.15 | 0.7 | 0.3 | 0.7 | 0.3 | 1.0 | 27 | 20 | 33 | 20 | 30 | 20 | 1.06 | 1.2 | 1.06 | 1.2 | 1.1 | 1.38 | | CO7 | hh | 25.95 |
| PBTC-3G | 10-3000 | 0.15 | 0.7 | 0.3 | 1.5 | 1.0 | 2.5 | 27 | 20 | 30 | 20 | 35 | 20 | 1.06 | 1.2 | 1.13 | 1.66 | 1.6 | 1.7 | | CO7 | hh | 35.95 |
| ❖ PBTC-1GW | 0.1-1000 | 0.15 | 0.8 | 0.3 | 0.7 | 0.3 | 1.0 | 25 | 15 | 33 | 20 | 30 | 20 | 1.06 | 1.6 | 1.06 | 1.2 | 1.1 | 1.38 | | CO7 | hh | 35.95 |
| ❖ PBTC-3GW | 0.1-3000 | 0.15 | 0.8 | 0.3 | 1.5 | 1.0 | 2.5 | 25 | 15 | 30 | 20 | 35 | 20 | 1.06 | 1.6 | 1.13 | 1.66 | 1.6 | 1.7 | | CO7 | hh | 46.95 |
| ZFBT-4R2G | 10-4200 | 0.15 | 0.6 | 0.6 | 1.2 | 0.6 | 1.6 | 32 | 20 | 40 | 20 | 50 | 20 | 1.06 | 1.2 | 1.13 | 1.3 | 1.13 | 1.3 | | K18 | gf | 59.95 |
| ZFBT-4R2G-FT | 10-4200 | 0.15 | 0.6 | 0.6 | 1.2 | 0.6 | 1.6 | | | | | | | 1.06 | 1.2 | 1.13 | 1.3 | 1.13 | 1.3 | | Y39 | hf | 59.95 |
| ZFBT-6G | 10-6000 | 0.15 | 0.6 | 0.6 | 1.4 | 1.0 | 2.2 | 32 | 20 | 40 | 20 | 30 | 17 | 1.06 | 1.2 | 1.13 | 1.3 | 1.13 | 1.5 | see | K18 | gf | 79.95 |
| ZFBT-6G-FT | 10-6000 | 0.15 | 0.6 | 0.6 | 1.4 | 1.0 | 2.2 | | | | | | | 1.06 | 1.2 | 1.13 | 1.3 | 1.13 | 1.5 | | Y39 | hf | 79.95 |
| ❖ ZFBT-4R2GW | 0.1-4200 | 0.15 | 0.8 | 0.6 | 1.2 | 0.6 | 1.6 | 25 | 15 | 40 | 20 | 50 | 20 | 1.06 | 1.6 | 1.13 | 1.3 | 1.13 | 1.3 | below | K18 | gf | 79.95 |
| ❖ ZFBT-4R2GW-FT | 0.1-4200 | 0.15 | 0.8 | 0.6 | 1.2 | 0.6 | 1.6 | | | | | | | 1.06 | 1.6 | 1.13 | 1.3 | 1.13 | 1.3 | | Y39 | hf | 79.95 |
| ❖ ZFBT-6GW | 0.1-6000 | 0.15 | 0.8 | 0.6 | 1.4 | 1.0 | 2.2 | 25 | 15 | 40 | 20 | 30 | 17 | 1.06 | 1.6 | 1.13 | 1.3 | 1.13 | 1.5 | | K18 | gf | 89.95 |
| ❖ ZFBT-6GW-FT | 0.1-6000 | 0.15 | 0.8 | 0.6 | 1.4 | 1.0 | 2.2 | | | | | | | 1.06 | 1.6 | 1.13 | 1.3 | 1.13 | 1.5 | | Y39 | hf | 89.95 |

L = low range ($f_L$ to 10 $f_L$) M = mid range (10 $f_L$ to $f_U$/2) U = upper range ($f_U$/2 to $f_U$)




## PERFORMANCE DATA FOR ZFBT SERIES

| FREQ. (MHz) | Pin (dBm) | INSERTION LOSS (dB) with current 0mA | 20mA | 50mA | 100mA | 150mA | 200mA | ISOLATION (dB) (Pin = -10dBm) with current 10mA | 20mA | 50mA | 100mA | 150mA | 200mA | VSWR (:1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 19.8 | 0.17 | 0.17 | 0.16 | 0.17 | 0.20 | 0.24 | 19.46 | 19.04 | 17.83 | 14.58 | 12.66 | 11.75 | 1.16 |
| 0.266 | 19.8 | 0.13 | 0.13 | 0.13 | 0.14 | 0.14 | 0.15 | 25.86 | 25.53 | 24.52 | 21.43 | 19.31 | 18.16 | 1.07 |
| 0.531 | 19.8 | 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.11 | 29.17 | 28.98 | 28.36 | 26.18 | 24.40 | 23.37 | 1.04 |
| 1.059 | 19.8 | 0.13 | 0.13 | 0.12 | 0.11 | 0.12 | 0.12 | 30.81 | 30.74 | 30.56 | 29.62 | 28.62 | 27.92 | 1.02 |
| 10.000 | 18.5 | 0.16 | 0.17 | 0.17 | 0.16 | 0.16 | 0.16 | 30.06 | 30.07 | 30.07 | 30.20 | 30.38 | 30.56 | 1.04 |
| 114.750 | 19.5 | 0.22 | 0.25 | 0.24 | 0.22 | 0.22 | 0.22 | 34.45 | 34.49 | 34.27 | 33.99 | 33.83 | 33.59 | 1.07 |
| 324.250 | 19.7 | 0.50 | 0.55 | 0.53 | 0.52 | 0.53 | 0.56 | 44.65 | 44.61 | 44.25 | 43.90 | 43.91 | 43.34 | 1.06 |
| 743.250 | 18.7 | 0.28 | 0.31 | 0.30 | 0.29 | 0.29 | 0.29 | 51.19 | 50.50 | 50.16 | 50.65 | 51.69 | 52.47 | 1.06 |
| 952.750 | 18.2 | 0.31 | 0.33 | 0.33 | 0.31 | 0.32 | 0.33 | 40.75 | 40.80 | 40.97 | 40.97 | 40.93 | 40.95 | 1.11 |
| 1581.250 | 18.0 | 0.46 | 0.48 | 0.47 | 0.46 | 0.48 | 0.49 | 42.58 | 42.59 | 43.94 | 43.77 | 44.36 | 44.17 | 1.13 |
| 2000.250 | 17.1 | 0.46 | 0.48 | 0.47 | 0.46 | 0.46 | 0.47 | 45.46 | 45.57 | 45.73 | 45.48 | 46.14 | 45.28 | 1.12 |
| 2524.000 | 14.4 | 0.40 | 0.42 | 0.41 | 0.42 | 0.43 | 0.44 | 53.15 | 53.72 | 52.19 | 53.17 | 52.67 | 53.67 | 1.12 |
| 3047.750 | 14.2 | 0.45 | 0.48 | 0.47 | 0.46 | 0.46 | 0.49 | 52.46 | 52.25 | 51.55 | 51.33 | 51.46 | 50.99 | 1.09 |
| 3676.250 | 15.1 | 0.73 | 0.74 | 0.75 | 0.75 | 0.75 | 0.75 | 46.32 | 47.19 | 46.36 | 45.53 | 46.19 | 45.65 | 1.07 |
| 4200.000 | 17.9 | 1.04 | 1.07 | 1.07 | 1.06 | 1.05 | 1.06 | 28.42 | 28.36 | 28.24 | 28.14 | 28.01 | 27.92 | 1.09 |
| 4502.500 | -0.6 | 1.17 | 1.19 | 1.18 | 1.19 | 1.17 | 1.16 | 28.15 | 28.10 | 28.05 | 27.96 | 27.84 | 27.87 | 1.14 |
| 4802.000 | -0.7 | 1.26 | 1.26 | 1.27 | 1.25 | 1.22 | 1.20 | 37.95 | 38.01 | 38.19 | 37.93 | 37.58 | 37.51 | 1.12 |
| 5251.250 | -1.1 | 1.19 | 1.17 | 1.16 | 1.13 | 1.11 | 1.09 | 49.68 | 51.04 | 49.12 | 49.37 | 49.13 | 48.19 | 1.11 |
| 5550.750 | -2.0 | 1.65 | 1.63 | 1.60 | 1.56 | 1.54 | 1.51 | 38.44 | 38.56 | 38.36 | 38.07 | 37.85 | 38.19 | 1.10 |
| 6000.000 | -2.4 | 1.70 | 1.71 | 1.65 | 1.59 | 1.54 | 1.50 | 34.37 | 34.36 | 34.23 | 34.40 | 34.49 | 34.48 | 1.12 |

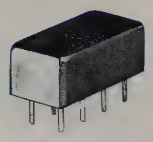
CAPD now available! computer-automated performance data

## In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

## LINEAR TUNING 25 to 2000 MHz



POS

| MODEL NO. | FREQ. MHz Min. | Max. | POWER OUTPUT dBm Typ. | PHASE NOISE, typ. dBc/Hz SSB @ offset frequencies: 10 kHz | 100 kHz | PULLING MHz pk-pk @ 12 dBr Typ. | PUSHING MHz/V Typ. | TUNING SENSITIVITY MHz/V Typ. | HARMONICS dBc Typ. | Max. | DC SUPPLY V Nom. | mA Max. | CAPD DATA Page | Case Style Note B | CONNECTION | Price $ Qty (5-49) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| POS-50 | 25 | 50 | +8.5 | -110 | -130 | 0.06 | 0.04 | 2.0 - 2.6 | -19 | -12 | 12 | 20 | 159 | A06 | hx | 11.95 |
| POS-75 | 37.5 | 75 | +8 | -110 | -130 | 0.15 | 0.11 | 3.1 - 3.8 | -27 | -20 | 12 | 20 | 159 | A06 | hx | 11.95 |
| POS-100 | 50 | 100 | +8.3 | -107 | -130 | 0.6 | 0.2 | 4.2 - 4.8 | -23 | -18 | 12 | 20 | 160 | A06 | hx | 11.95 |
| POS-150 | 75 | 150 | +9.5 | -103 | -127 | 0.8 | 0.3 | 5.8 - 6.7 | -23 | -17 | 12 | 20 | 161 | A06 | hx | 11.95 |
| POS-200 | 100 | 200 | +10 | -102 | -122 | 1.0 | 0.2 | 7.1 - 8.6 | -24 | -20 | 12 | 20 | 162 | A06 | hx | 11.95 |
| POS-300 | 150 | 280 | +10 | -100 | -120 | 1.8 | 0.3 | 9.5 - 13 | -30 | -20 | 12 | 20 | 163 | A06 | hx | 13.95 |
| POS-400 | 200 | 380 | +9.5 | -98 | -120 | 1.8 | 0.3 | 13.7 - 16.9 | -28 | -20 | 12 | 20 | 164 | A06 | hx | 13.95 |
| POS-535 | 300 | 525 | +8.8 | -93 | -116 | 2.0 | 0.4 | 10.5 - 24 | -26 | -20 | 12 | 20 | 165 | A06 | hx | 13.95 |
| POS-765 | 485 | 765 | +9.5 | -85 | -108 | 5.0 | 0.4 | 18 - 27 | -21 | -17 | 12 | 22 | 166 | A06 | hx | 14.95 |
| POS-1025 | 685 | 1025 | +9 | -84 | -104 | 5.0 | 0.6 | 21 - 36 | -23 | -18 | 12 | 22 | 167 | A06 | hx | 16.95 |
| NEW POS-1060 | 750 | 1060 | +12 | -90 | -112 | 50 | 3 | 18 - 32 | -11 | --- | 8 | 30 | --- | A06 | hx | 14.95 |
| NEW POS-1400 | 975 | 1400 | +13 | -95 | -115 | 36 | 1.5 | 21-43 | -11 | --- | 8 | 30 | --- | A06 | hx | 14.95 |
| NEW POS-2000 | 1370 | 2000 | +10 | -95 | -115 | 28 | 1.5 | 30-50 | -11 | --- | 8 | 30 | --- | A06 | hx | 14.95 |

### features

- Octave bandwidth range (typ.)
- Linear tuning
- Low phase noise, characterized at 100 Hz to 1 MHz offsets
- Excellent harmonic suppression
- Output suitable for LO drive to mixers
- Low power consumption, typically 190 mW (most models)
- Usable with +15V supply for higher power output, typically 2 dB
- Useful in digital cordless phones, cellular up-and-down converters, CATV distribution and set top converters, wideband frequency synthesizers, test instruments, signal generators and agile communications systems

NOTES:

A. General Quality Control Procedures, Environmental specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.

| | POS-50 to -1025 | POS-1060 to -2000 |
|---|---|---|
| 1. Tuning Voltage required to cover frequency range: | 1 to 16V | 1 to 20V |
| 1a. Absolute Max. Supply Voltage ($V_{cc}$): | +16V | +10V |
| 1b. Absolute Max. Tuning Voltage ($V_{tune}$): | +18V, (+17V for POS-50) | +22V |
| 2. 3 dB modulation bandwidth: | 100 kHz typ. | 1 MHz typ. |
| 3. Operating Temperature: -55°C to +85°C | | |

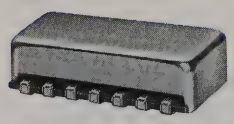
## designers kits available

| KIT NO. | No. of Units in Kit | DESCRIPTION | PRICE $ per kit |
|---|---|---|---|
| K-POS1 | 10 | 1 of each 50, 75, 100, 150, 200, 300 400, 535, 765, 1025 | 124.95 |
| K-POS2 | 7 | 1 of each 50, 100,200, 400, 535, 765, 1025 | 79.95 |
| K-POS3 | 6 | 2 of each 1060, 1400, 2000 | 79.95 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# 25 to 1025 MHz



JTOS

| MODEL NO. | FREQ. MHz | POWER OUTPUT dBm | PHASE NOISE dBc/ Hz SSB at offset frequencies: Typ. | | | | PULLING MHz pk-pk @12 dBr | PUSHING MHz/V | TUNING SENSITIVITY MHz/V | HARMONICS dBc | | 3 dB MODULATION BANDWIDTH KHz | POWER SUPPLY | | CAPD DATA | Case Style | CONNECTION | Price $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 kHz | 10 kHz | 100 kHz | 1 MHz | | | | | | | VOLTAGE V | CURRENT mA Max. | | Note B | | Qty (5-49) |
| | Min. Max. | Typ. | | | | | Typ. | Typ. | Typ. | Typ. | Max. | Typ. | | | Page | | | |
| NEW JTOS-50 | 25 - 47 | +8.5 | -88 | -108 | -127 | -147 | 0.06 | 0.04 | 2.0 - 2.6 | -19 | -12 | 50 | 12 | 20 | 159 | BK377 | jc | 13.95 |
| NEW JTOS-75 | 37.5 - 75 | +8.0 | -89 | -110 | -130 | -140 | 0.15 | 0.11 | 2.8 - 4.0 | -27 | -20 | 125 | 12 | 20 | 159 | BK377 | jc | 13.95 |
| NEW JTOS-100 | 50 - 100 | +8.3 | -83 | -108 | -128 | -140 | 0.6 | 0.2 | 3.7 - 4.8 | -35 | -20 | 100 | 12 | 18 | 160 | BK377 | jc | 13.95 |
| NEW JTOS-150 | 75 - 150 | +9.5 | -82 | -106 | -127 | -147 | 0.8 | 0.3 | 5.8 - 6.7 | -23 | -17 | 112 | 12 | 20 | 161 | BK377 | jc | 13.95 |
| NEW JTOS-200 | 100 - 200 | +10.0 | -84 | -105 | -124 | -145 | 1.0 | 0.2 | 6 - 10 | -25 | -20 | 110 | 12 | 20 | 162 | BK377 | jc | 13.95 |
| NEW JTOS-300 | 150 - 280 | +9.0 | -82 | -102 | -122 | -142 | 1.0 | 0.2 | 9 - 14 | -28 | -20 | 120 | 12 | 20 | 163 | BK377 | jc | 15.95 |
| NEW JTOS-400 | 200 - 380 | +9.0 | -82 | -102 | -122 | -142 | 1.4 | 0.4 | 10.5 - 17.1 | -25 | -20 | 130 | 12 | 20 | 164 | BK377 | jc | 15.95 |
| NEW JTOS-535 | 300 - 525 | +9.5 | -75 | -97 | -117 | -137 | 2.0 | 0.5 | 10 - 24 | -28 | -20 | 115 | 12 | 20 | 165 | BK377 | jc | 15.95 |
| NEW JTOS-765 | 485 - 765 | +8.0 | -75 | -98 | -118 | -138 | 2.0 | 0.5 | 20 - 30 | -30 | -20 | 100 | 12 | 20 | 166 | BK377 | jc | 16.95 |
| NEW JTOS-1025 | 685 - 1025 | +8.6 | -70 | -94 | -114 | -134 | 5.0 | 0.6 | 21 - 36 | -28 | -20 | 100 | 12 | 22 | 167 | BK377 | jc | 18.95 |

## features

- wide frequency range
- linear tuning characteristics
- excellent harmonic suppression
- low phase noise

NOTES:

A. Environmental specifications and re-flow soldering information available in General Information Section.
B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Tuning Voltage 1V to 16V (1V to 15V for JTOS-50) required to cover frequency range.
   1a. Absolute Max. Supply Voltage ($V_{cc}$): +16V
   1b. Absolute Max. Tuning Voltage ($V_{tune}$): +18V, (+17V for JTOS-50)
2. Operating Temperature: -55°C to +85°C

## pin connections

see case style outline drawings

| PORT | jc | hx |
|---|---|---|
| RF OUT | 13 | 2 |
| V-CC | 2 | 1 |
| V-TUNE | 5 | 8 |
| GND EXT | 1,3,4,6,7,8,9, 10,11,12,14 | 3,4,5,6,7 |

In Stock... Immediate Delivery

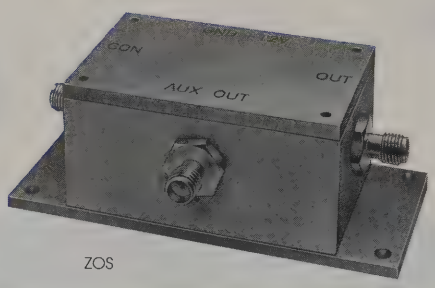
For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

# VOLTAGE CONTROLLED OSCILLATORS



## DUAL OUTPUT 25 to 1025 MHz



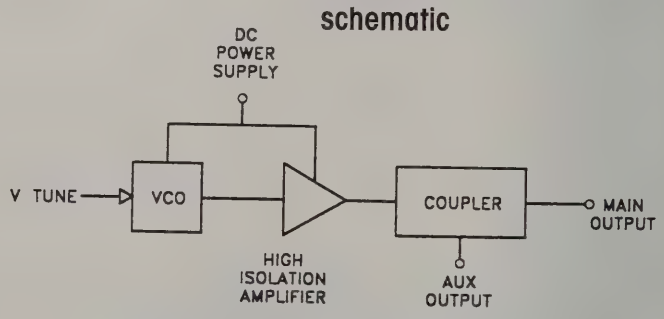

ZOS

| MODEL NO. | FREQ. MHz | | POWER OUTPUT dBm Typ. | | TUNING VOLTAGE V | | PHASE NOISE dBc/ Hz SSB at offset frequencies: Typ. | | | PULLING MHz pk-pk (Open/Short) | PUSHING MHz/V | TUNING SENSITIVITY MHz/V | HARMONICS dBc | | POWER SUPPLY | | CAPD DATA | Case Style | Price $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | VOLTAGE V | CURRENT mA Max. | | | |
| | Min. | Max. | Main. | Aux. | Min. | Max. | 10 kHz | 100 kHz | 1MHz | Typ. | Typ. | Typ. | Typ. | Max. | | | Page | Note B | Qty (1-9) |
| ZOS-50 | 25 | 50 | +9 | -12 | 1 | 16 | -107 | -126 | -141 | 0.012 | 0.08 | 2.5 | -22 | -12 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-75 | 37.5 | 75 | +9 | -12 | 1 | 16 | -110 | -128 | -142 | 0.016 | 0.15 | 3.5 | -26 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-100 | 50 | 100 | +9 | -12 | 1 | 16 | -111 | -131 | -143 | 0.026 | 0.25 | 4.5 | -29 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-150 | 75 | 150 | +9 | -12 | 1 | 16 | -107 | -127 | -142 | 0.017 | 0.39 | 5.8 | -26 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-200 | 100 | 200 | +10 | -11 | 1 | 16 | -106 | -126 | -141 | 0.015 | 0.42 | 7.7 | -25 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-300 | 150 | 280 | +9 | -13 | 1 | 16 | -103 | -123 | -142 | 0.017 | 0.50 | 11 | -27 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-400 | 200 | 380 | +10 | -13 | 1 | 16 | -100 | -120 | -136 | 0.021 | 0.50 | 15 | -24 | -18 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-535 | 300 | 525 | +9 | -13 | 1 | 16 | -96 | -118 | -131 | 0.018 | 0.50 | 18 | -27 | -20 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-765 | 485 | 765 | +8.5 | -14 | 1 | 16 | -96 | -117 | -132 | 0.033 | 0.72 | 22 | -27 | -17 | 12 | 140 | 168 | BR386 | 119.95 |
| ZOS-1025 | 685 | 1025 | +8 | -13 | 1 | 16 | -92 | -112 | -136 | 0.051 | 1.00 | 30 | -25 | -18 | 12 | 140 | 168 | BR386 | 119.95 |

### features

- octave bandwidth
- linear tuning
- excellent harmonic suppression
- auxiliary output for frequency monitoring/phase locked loops
- main & auxiliary ports have excellent isolation from main oscillator (50 dB typ.)
- load insensitive
- at 12 dBr, pulling comparable to short term stability

### schematic



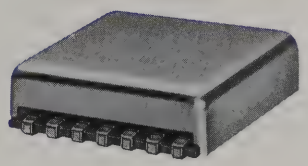

NOTES:

A. General Quality Control Procedures, Environmental specifications, Hi-Rel, MIL and TX description are given in General Information (Section 0).
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Tuning Voltage 1 to 16V (1 to 15V for ZOS-50 required to cover frequency range.
   1a. Absolute Max. Supply Voltage ($V_{cc}$): +16V
   1b. Absolute Max. Tuning Voltage ($V_{tune}$): +18V, (+17V for ZOS-50)
2. 3 dB modulation bandwidth: 100 kHz
3. Operating Temperature: -55°C to +85°C



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# LOW NOISE 780 to 1114 MHz



JCOS

| MODEL NO. | FREQ. MHz Min. Max. | POWER OUTPUT dBm Typ. | TUNING VOLTAGE V Min. | Max. | PHASE NOISE dBc/ Hz SSB at offset frequencies: Typ. 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | PULLING MHz pk-pk @12 dBr Typ. | PUSHING MHz/V Typ. | TUNING SENSITIVITY MHz/V Typ. | HARMONICS dBc Typ. | Max. | POWER SUPPLY VOLTAGE V | CURRENT mA Max. | CAPD DATA Page | Case Style Note B | CONNECTION | Price $ Qty (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JCOS-820WLN | 780-860 | +9 | 0 | 20 | -60 | -90 | -112 | -132 | -150 | 4.5 | 0.3 | 8 | -13 | -8 | 9 | 25 | 158 | BG419 | jd | 49.95 |
| JCOS-820BLN | 807-832 | +3 | 1 | 14 | -57 | -88 | -112 | -132 | -151 | 0.4 | 0.4 | 6 | -24 | -20 | 10 | 25 | 158 | BG419 | jd | 49.95 |
| JCOS-1100LN | 1079-1114 | +8.5 | 0 | 20 | -60 | -88 | -110 | -130 | -150 | 7.5 | 0.5 | 4.5 | -15 | -10 | 8 | 25 | 158 | BG419 | jd | 49.95 |

NOTES:

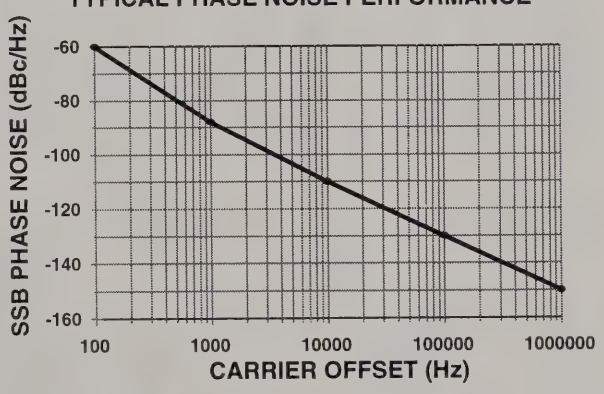
A. Environmental specifications and re-flow soldering information available in General Information Section.
B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute Maximum Ratings:
   1a. Absolute Max. Supply Voltage ($V_{cc}$): +15V JCOS
   1b. Absolute Max. Tuning Voltage ($V_{tune}$): +24V JCOS
   1c. Operating Temperature: -55°C to +85°C

## pin connections

see case style outline drawings for pin locations

| PORT | jd |
|---|---|
| RF OUT | 7 |
| V-CC | 8 |
| V-TUNE | 1 |
| GND EXT | 2,3,4,5,6,9 10,11,12,13,14 |

TYPICAL PHASE NOISE PERFORMANCE




CAPD now available! computer-automated performance data

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

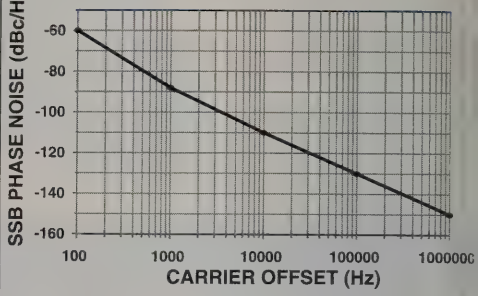
# VOLTAGE CONTROLLED OSCILLATORS

## LOW NOISE

### JCOS-820WLN

| V tune (V) | FREQUENCY (MHz) | | | SENSITIVITY (MHz/V) | | | Pout (dBm) | | | 2nd HARMONIC (dBc) | | | 3rd HARMONIC (dBc) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° |
| 0 | 748.34 | 746.70 | 744.95 | — | — | — | 13.33 | 13.05 | 10.79 | -10.65 | -11.35 | -15.78 | -20.77 | -22.70 | -26.53 |
| 1 | 756.34 | 755.01 | 753.18 | 8.00 | 8.31 | 8.22 | 13.51 | 13.14 | 11.37 | -11.17 | -11.73 | -14.96 | -21.39 | -22.93 | -25.68 |
| 2 | 762.99 | 761.79 | 759.71 | 6.65 | 6.78 | 6.53 | 13.56 | 13.20 | 11.71 | -11.78 | -12.54 | -15.18 | -21.60 | -22.84 | -25.36 |
| 3 | 769.65 | 768.41 | 766.04 | 6.66 | 6.63 | 6.33 | 13.33 | 13.09 | 12.07 | -12.63 | -13.28 | -15.71 | -23.09 | -23.91 | -25.47 |
| 4 | 776.80 | 775.46 | 772.67 | 7.16 | 7.04 | 6.64 | 12.94 | 12.79 | 12.12 | -13.50 | -14.14 | -16.22 | -23.22 | -24.52 | -26.81 |
| 5 | 784.48 | 782.99 | 779.80 | 7.68 | 7.54 | 7.13 | 12.61 | 12.52 | 12.03 | -14.02 | -14.58 | -16.40 | -24.76 | -25.38 | -26.86 |
| 6 | 792.70 | 791.14 | 787.54 | 8.22 | 8.15 | 7.74 | 12.58 | 12.45 | 12.00 | -14.14 | -14.58 | -16.10 | -25.90 | -26.97 | -28.82 |
| 7 | 801.36 | 799.70 | 795.75 | 8.66 | 8.56 | 8.21 | 12.85 | 12.70 | 12.19 | -14.65 | -14.78 | -15.59 | -30.03 | -29.89 | -29.79 |
| 8 | 810.21 | 808.39 | 804.29 | 8.85 | 8.69 | 8.54 | 13.11 | 13.03 | 12.38 | -15.21 | -15.31 | -15.80 | -34.41 | -34.06 | -33.46 |
| 9 | 819.17 | 816.89 | 813.71 | 8.96 | 8.50 | 9.42 | 12.89 | 12.89 | 11.82 | -15.03 | -15.47 | -16.92 | -40.91 | -38.29 | -35.49 |
| 10 | 828.54 | 826.75 | 824.30 | 9.38 | 9.86 | 10.59 | 12.36 | 11.84 | 10.74 | -14.77 | -15.64 | -17.85 | -41.00 | -38.36 | -38.51 |
| 11 | 837.95 | 836.81 | 834.42 | 9.41 | 10.07 | 10.12 | 11.76 | 11.20 | 10.17 | -15.00 | -15.91 | -18.21 | -41.96 | -40.25 | -37.85 |
| 12 | 847.45 | 846.36 | 843.77 | 9.50 | 9.55 | 9.36 | 11.18 | 10.82 | 9.97 | -16.86 | -17.45 | -19.28 | -39.58 | -38.62 | -36.99 |
| 13 | 856.62 | 855.32 | 852.27 | 9.17 | 8.96 | 8.50 | 10.41 | 10.24 | 9.80 | -20.84 | -21.33 | -22.37 | -37.00 | -37.12 | -36.60 |
| 14 | 865.04 | 863.34 | 859.54 | 8.42 | 8.02 | 7.27 | 9.31 | 9.32 | 9.36 | -18.01 | -26.56 | -24.18 | -34.63 | -33.06 | -33.08 |
| 15 | 870.24 | 868.57 | 865.45 | 5.20 | 5.23 | 5.91 | 8.24 | 8.64 | 9.13 | -19.53 | -19.86 | -21.22 | -29.81 | -31.05 | -31.94 |
| 16 | 875.01 | 873.95 | 871.44 | 4.77 | 5.38 | 5.99 | 8.76 | 8.90 | 9.08 | -16.89 | -17.94 | -20.04 | -28.47 | -29.74 | -32.31 |
| 17 | 880.21 | 879.27 | 876.98 | 5.20 | 5.32 | 5.54 | 9.17 | 9.14 | 9.06 | -16.19 | -17.24 | -19.46 | -29.96 | -30.03 | -31.14 |
| 18 | 884.81 | 883.93 | 881.80 | 4.60 | 4.66 | 4.82 | 9.57 | 9.44 | 9.13 | -16.05 | -16.87 | -19.06 | -30.93 | -31.39 | -31.86 |
| 19 | 888.93 | 888.04 | 885.96 | 4.12 | 4.11 | 4.15 | 9.89 | 9.72 | 9.31 | -16.06 | -16.79 | -18.73 | -29.11 | -30.70 | -32.68 |
| 20 | 892.75 | 891.83 | 889.70 | 3.81 | 3.79 | 3.74 | 10.02 | 9.86 | 9.45 | -16.46 | -16.93 | -18.48 | -28.22 | -29.13 | -31.24 |

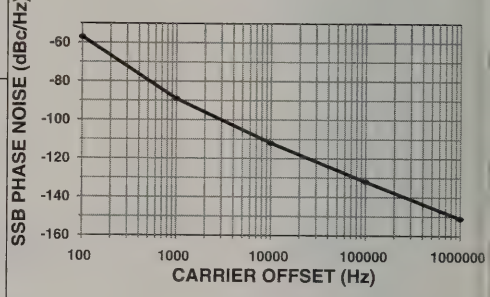
PHASE NOISE




### JCOS-820BLN

| V tune (V) | FREQUENCY (MHz) | | | SENSITIVITY (MHz/V) | | | Pout (dBm) | | | 2nd HARMONIC (dBc) | | | 3rd HARMONIC (dBc) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° |
| 0 | 781.68 | 779.73 | 776.34 | — | — | — | 4.45 | 4.46 | 4.05 | -23.10 | -29.20 | -27.78 | -46.79 | -57.40 | -57.79 |
| 1 | 788.05 | 786.20 | 782.90 | 6.37 | 6.47 | 6.56 | 4.48 | 4.50 | 4.12 | -29.45 | -29.39 | -26.70 | -46.82 | -55.63 | -58.19 |
| 2 | 793.33 | 791.46 | 788.11 | 5.28 | 5.26 | 5.21 | 4.51 | 4.54 | 4.15 | -29.61 | -29.51 | -26.15 | -45.87 | -54.90 | -57.82 |
| 3 | 798.36 | 796.46 | 793.02 | 5.03 | 5.00 | 4.91 | 4.56 | 4.59 | 4.18 | -30.01 | -29.89 | -25.53 | -46.17 | -55.89 | -56.16 |
| 4 | 803.54 | 801.58 | 798.08 | 5.18 | 5.12 | 5.06 | 4.58 | 4.61 | 4.23 | -30.42 | -30.30 | -25.28 | -48.07 | -54.51 | -56.81 |
| 5 | 809.07 | 807.04 | 803.43 | 5.53 | 5.46 | 5.35 | 4.58 | 4.62 | 4.23 | -30.79 | -30.82 | -27.55 | -47.21 | -54.21 | -57.73 |
| 6 | 815.13 | 813.00 | 809.27 | 6.06 | 5.96 | 5.84 | 4.54 | 4.60 | 4.17 | -31.32 | -31.14 | -29.10 | -45.22 | -52.33 | -55.57 |
| 7 | 821.70 | 819.43 | 815.71 | 6.57 | 6.43 | 6.44 | 4.45 | 4.50 | 3.98 | -31.26 | -32.02 | -29.37 | -44.35 | -50.76 | -54.86 |
| 8 | 829.56 | 826.18 | 822.80 | 6.86 | 6.75 | 7.09 | 4.32 | 4.35 | 3.66 | -31.51 | -32.82 | -30.54 | -43.60 | -50.11 | -52.45 |
| 9 | 835.18 | 832.93 | 830.29 | 6.62 | 6.76 | 7.49 | 4.02 | 3.99 | 3.21 | -31.88 | -33.80 | -32.77 | -41.19 | -48.20 | -50.32 |
| 10 | 841.21 | 840.08 | 837.80 | 6.04 | 7.14 | 7.52 | 3.31 | 3.16 | 2.55 | -32.70 | -35.20 | -33.24 | -37.77 | -45.44 | -48.91 |
| 11 | 847.38 | 846.70 | 844.77 | 6.17 | 6.62 | 6.97 | 2.32 | 2.32 | 2.05 | -33.12 | -35.12 | -38.84 | -35.61 | -43.40 | -47.23 |
| 12 | 852.63 | 852.27 | 851.22 | 5.25 | 5.58 | 6.45 | 2.97 | 2.61 | 1.96 | -33.48 | -33.88 | -38.87 | -36.87 | -43.11 | -45.67 |
| 13 | 858.98 | 858.52 | 857.53 | 6.35 | 6.25 | 6.31 | 3.27 | 2.88 | 2.01 | -33.15 | -33.68 | -37.23 | -37.51 | -44.64 | -46.40 |
| 14 | 865.29 | 864.76 | 863.67 | 6.31 | 6.24 | 6.14 | 3.27 | 2.93 | 2.04 | -34.25 | -34.18 | -34.95 | -38.88 | -45.79 | -48.61 |
| 15 | 871.22 | 870.62 | 869.41 | 5.92 | 5.85 | 5.74 | 3.13 | 2.86 | 2.05 | -34.60 | -34.47 | -36.43 | -38.33 | -45.63 | -48.47 |
| 16 | 876.52 | 875.88 | 874.57 | 5.31 | 5.26 | 5.15 | 2.98 | 2.77 | 2.04 | -35.02 | -35.02 | -37.49 | -39.32 | -44.95 | -48.84 |
| 17 | 881.30 | 880.60 | 879.17 | 4.78 | 4.72 | 4.60 | 2.77 | 2.64 | 2.00 | -35.63 | -35.43 | -37.10 | -39.56 | -45.16 | -48.60 |
| 18 | 885.56 | 884.84 | 883.33 | 4.26 | 4.24 | 4.16 | 2.55 | 2.46 | 1.88 | -35.64 | -35.94 | -36.38 | -40.65 | -45.96 | -48.73 |
| 19 | 889.31 | 888.55 | 887.00 | 3.75 | 3.71 | 3.66 | 2.39 | 2.34 | 1.81 | -35.71 | -36.46 | -35.92 | -40.47 | -46.49 | -49.40 |
| 20 | 892.61 | 891.84 | 890.23 | 3.30 | 3.29 | 3.24 | 2.25 | 2.23 | 1.75 | -35.87 | -36.90 | -36.71 | -40.24 | -46.73 | -45.93 |

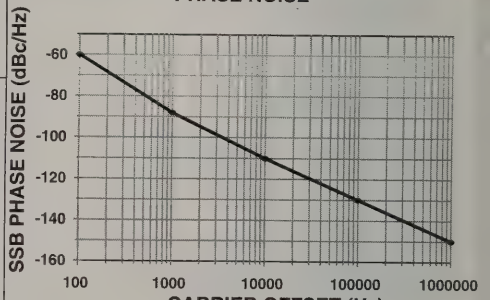
PHASE NOISE




### JCOS-1100LN

| V tune (V) | FREQUENCY (MHz) | | | SENSITIVITY (MHz/V) | | | Pout (dBm) | | | 2nd HARMONIC (dBc) | | | 3rd HARMONIC (dBc) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° | -20° | +25° | +85° |
| 0 | 1071.28 | 1067.10 | 1064.33 | — | — | — | 8.11 | 8.21 | 8.10 | -18.12 | -19.34 | -20.14 | -19.94 | -20.40 | -20.18 |
| 1 | 1075.49 | 1074.27 | 1068.42 | 4.21 | 4.17 | 4.08 | 8.00 | 8.19 | 8.15 | -17.68 | -18.93 | -20.00 | -19.81 | -20.36 | -20.98 |
| 2 | 1079.06 | 1071.26 | 1071.86 | 3.56 | 3.56 | 3.44 | 7.94 | 8.14 | 8.15 | -17.35 | -18.62 | -19.60 | -20.07 | -20.07 | -21.17 |
| 3 | 1082.46 | 1078.30 | 1075.24 | 3.40 | 3.48 | 3.38 | 7.91 | 8.06 | 8.09 | -17.02 | -18.30 | -19.32 | -20.19 | -19.71 | -20.81 |
| 4 | 1085.88 | 1081.87 | 1078.78 | 3.42 | 3.57 | 3.54 | 7.93 | 8.00 | 8.03 | -16.64 | -17.91 | -18.32 | -19.90 | -19.71 | -20.41 |
| 5 | 1089.45 | 1085.62 | 1082.57 | 3.57 | 3.74 | 3.79 | 7.99 | 8.00 | 7.97 | -16.25 | -17.61 | -18.54 | -19.53 | -19.73 | -19.87 |
| 6 | 1093.29 | 1089.59 | 1086.67 | 3.84 | 3.97 | 4.10 | 8.08 | 8.03 | 7.97 | -15.83 | -17.08 | -18.08 | -19.41 | -19.78 | -19.90 |
| 7 | 1097.49 | 1093.85 | 1091.01 | 4.19 | 4.26 | 4.34 | 8.19 | 8.13 | 8.01 | -15.52 | -16.51 | -17.48 | -19.62 | -19.82 | -20.09 |
| 8 | 1102.04 | 1098.43 | 1095.61 | 4.55 | 4.58 | 4.60 | 8.34 | 8.23 | 8.09 | -15.33 | -16.10 | -16.89 | -19.44 | -19.98 | -20.06 |
| 9 | 1106.78 | 1103.26 | 1100.42 | 4.74 | 4.83 | 4.80 | 8.54 | 8.38 | 8.22 | -15.27 | -15.92 | -16.55 | -19.80 | -19.58 | -20.02 |
| 10 | 1111.61 | 1108.17 | 1105.35 | 4.82 | 4.91 | 4.93 | 8.71 | 8.59 | 8.39 | -15.14 | -15.91 | -16.36 | -20.47 | -19.87 | -19.77 |
| 11 | 1116.51 | 1113.02 | 1110.26 | 4.91 | 4.84 | 4.91 | 8.77 | 8.77 | 8.59 | -14.76 | -15.71 | -16.38 | -20.64 | -20.47 | -20.13 |
| 12 | 1121.67 | 1117.97 | 1115.16 | 5.17 | 4.96 | 4.89 | 8.75 | 8.84 | 8.74 | -14.26 | -15.33 | -16.24 | -20.63 | -20.42 | -20.86 |
| 13 | 1126.97 | 1123.06 | 1120.01 | 5.29 | 5.08 | 4.86 | 8.67 | 8.81 | 8.80 | -14.04 | -14.98 | -15.87 | -20.50 | -20.18 | -20.43 |
| 14 | 1132.08 | 1128.23 | 1124.96 | 5.11 | 5.17 | 4.94 | 8.62 | 8.73 | 8.78 | -14.01 | -14.81 | -15.53 | -20.39 | -19.93 | -19.99 |
| 15 | 1136.77 | 1133.13 | 1129.85 | 4.70 | 4.90 | 4.89 | 8.60 | 8.69 | 8.71 | -13.90 | -14.89 | -15.60 | -20.12 | -19.86 | -19.96 |
| 16 | 1141.04 | 1137.50 | 1134.33 | 4.27 | 4.37 | 4.48 | 8.59 | 8.65 | 8.66 | -13.89 | -14.91 | -15.73 | -20.10 | -19.54 | -19.88 |
| 17 | 1144.88 | 1141.36 | 1138.28 | 3.84 | 3.86 | 3.95 | 8.55 | 8.65 | 8.63 | -14.08 | -14.94 | -15.74 | -19.79 | -19.59 | -19.56 |
| 18 | 1148.24 | 1144.74 | 1141.69 | 3.36 | 3.38 | 3.41 | 8.54 | 8.63 | 8.64 | -14.54 | -15.01 | -15.71 | -19.03 | -19.54 | -19.65 |
| 19 | 1151.02 | 1147.64 | 1144.62 | 2.78 | 2.90 | 2.93 | 8.57 | 8.68 | 8.69 | -14.96 | -15.05 | -15.41 | -18.47 | -19.33 | -19.62 |
| 20 | 1153.13 | 1150.02 | 1147.15 | 2.11 | 2.37 | 2.53 | 8.72 | 8.81 | 8.80 | -14.57 | -14.49 | -14.85 | -18.38 | -19.24 | -19.97 |

PHASE NOISE



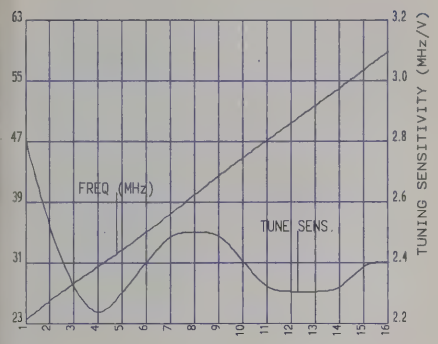



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

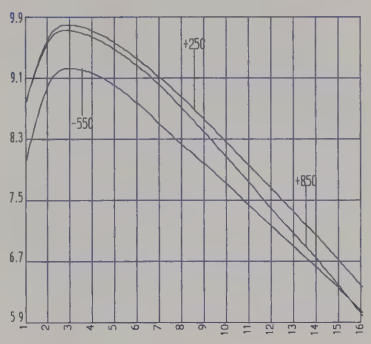
## POS-50/JTOS-50

25 to 50 MHz

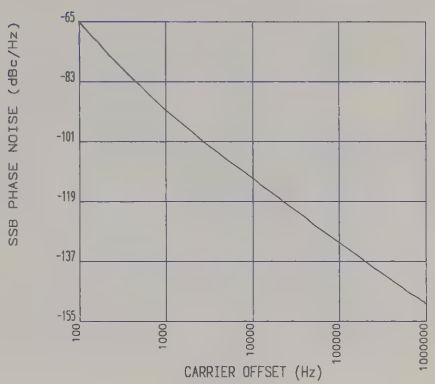
TUNING CHARACTERISTICS




POWER OUTPUT




PHASE NOISE




| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 23.3 | 2.8 |
| 2.0 | 25.9 | 2.5 |
| 3.0 | 28.2 | 2.3 |
| 4.0 | 30.4 | 2.2 |
| 5.0 | 32.6 | 2.3 |
| 6.0 | 35.0 | 2.4 |
| 7.0 | 37.4 | 2.5 |
| 8.0 | 40.0 | 2.5 |
| 9.0 | 42.5 | 2.5 |
| 10.0 | 44.9 | 2.4 |
| 11.0 | 47.2 | 2.3 |
| 12.0 | 49.5 | 2.3 |
| 13.0 | 51.8 | 2.3 |
| 14.0 | 54.1 | 2.3 |
| 15.0 | 56.5 | 2.4 |
| 16.0 | 58.9 | 2.4 |

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| | 8.06 | 8.85 | 8.85 |
| | 9.26 | 9.85 | 9.80 |
| | 9.31 | 9.89 | 9.81 |
| | 9.23 | 9.80 | 9.71 |
| | 9.06 | 9.63 | 9.54 |
| | 8.82 | 9.41 | 9.32 |
| | 8.53 | 9.16 | 9.06 |
| | 8.25 | 8.89 | 8.74 |
| | 8.00 | 8.59 | 8.42 |
| | 7.73 | 8.28 | 8.08 |
| | 7.44 | 7.97 | 7.75 |
| | 7.16 | 7.67 | 7.38 |
| | 6.89 | 7.34 | 7.06 |
| | 6.62 | 7.04 | 6.73 |
| | 6.33 | 6.70 | 6.36 |
| | 6.02 | 6.36 | 5.98 |

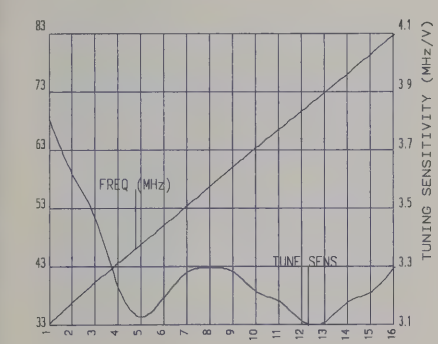
PHASE NOISE

| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -65 |
| 1000 | -93 |
| 10000 | -112 |
| 100000 | -132 |
| 1000000 | -150 |

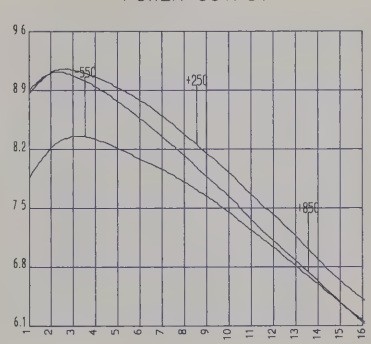
## POS-75/JTOS-75

37.5 to 75 MHz

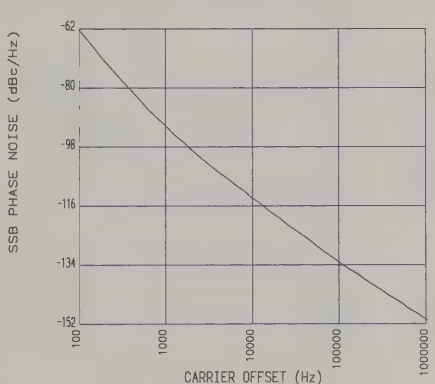
TUNING CHARACTERISTICS




POWER OUTPUT




PHASE NOISE




| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 33.5 | 3.8 |
| 2.0 | 37.1 | 3.6 |
| 3.0 | 40.5 | 3.5 |
| 4.0 | 43.7 | 3.2 |
| 5.0 | 46.9 | 3.1 |
| 6.0 | 50.1 | 3.2 |
| 7.0 | 53.4 | 3.3 |
| 8.0 | 56.7 | 3.3 |
| 9.0 | 60.0 | 3.3 |
| 10.0 | 63.2 | 3.2 |
| 11.0 | 66.3 | 3.2 |
| 12.0 | 69.4 | 3.1 |
| 13.0 | 72.5 | 3.1 |
| 14.0 | 75.7 | 3.2 |
| 15.0 | 79.0 | 3.2 |
| 16.0 | 82.2 | 3.3 |

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| | 7.88 | 8.89 | 8.93 |
| | 8.29 | 9.20 | 9.20 |
| | 8.40 | 9.18 | 9.10 |
| | 8.35 | 9.09 | 8.98 |
| | 8.23 | 8.96 | 8.79 |
| | 8.10 | 8.81 | 8.59 |
| | 7.98 | 8.62 | 8.36 |
| | 7.82 | 8.39 | 8.14 |
| | 7.65 | 8.16 | 7.87 |
| | 7.46 | 7.94 | 7.66 |
| | 7.23 | 7.65 | 7.35 |
| | 7.04 | 7.42 | 7.10 |
| | 6.80 | 7.17 | 6.87 |
| | 6.59 | 6.87 | 6.62 |
| | 6.36 | 6.62 | 6.36 |
| | 6.15 | 6.41 | 6.13 |

Phase Noise

| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -62 |
| 1000 | -93 |
| 10000 | -113 |
| 100000 | -133 |
| 1000000 | -150 |

In Stock... Immediate Delivery

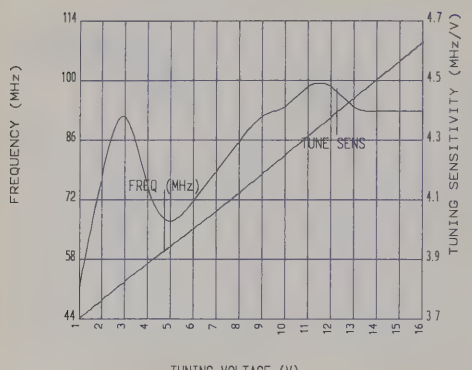
For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

## POS-100/JTOS-100

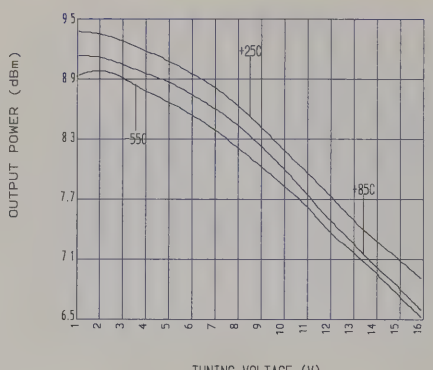
**50 to 100 MHz**

### TUNING CHARACTERISTICS



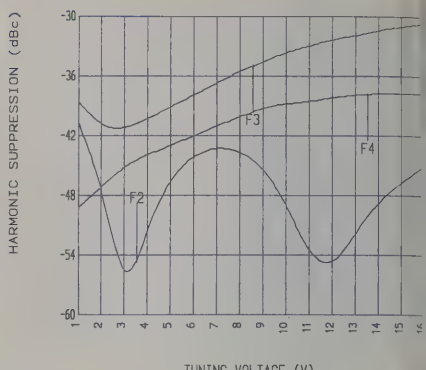

| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 44.4 | 3.8 |
| 2.0 | 48.6 | 4.2 |
| 3.0 | 53.2 | 4.5 |
| 4.0 | 57.3 | 4.1 |
| 5.0 | 61.3 | 4.0 |
| 6.0 | 65.4 | 4.1 |
| 7.0 | 69.6 | 4.2 |
| 8.0 | 73.9 | 4.3 |
| 9.0 | 78.3 | 4.4 |
| 10.0 | 82.8 | 4.4 |
| 11.0 | 87.2 | 4.5 |
| 12.0 | 91.7 | 4.5 |
| 13.0 | 96.1 | 4.4 |
| 14.0 | 100.5 | 4.4 |
| 15.0 | 104.8 | 4.4 |
| 16.0 | 109.2 | 4.4 |

### POWER OUTPUT



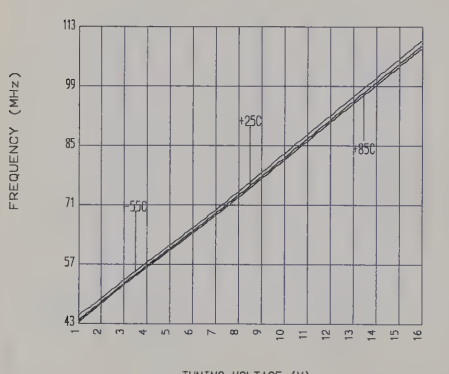

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| 1.0 | 8.98 | 9.42 | 9.17 |
| 2.0 | 9.05 | 9.40 | 9.17 |
| 3.0 | 8.95 | 9.32 | 9.08 |
| 4.0 | 8.80 | 9.22 | 8.99 |
| 5.0 | 8.71 | 9.12 | 8.91 |
| 6.0 | 8.57 | 8.99 | 8.78 |
| 7.0 | 8.43 | 8.86 | 8.64 |
| 8.0 | 8.24 | 8.67 | 8.48 |
| 9.0 | 8.06 | 8.46 | 8.26 |
| 10.0 | 7.86 | 8.22 | 8.04 |
| 11.0 | 7.67 | 8.00 | 7.78 |
| 12.0 | 7.38 | 7.77 | 7.51 |
| 13.0 | 7.21 | 7.52 | 7.30 |
| 14.0 | 6.99 | 7.31 | 7.04 |
| 15.0 | 6.76 | 7.13 | 6.85 |
| 16.0 | 6.54 | 6.93 | 6.61 |

### HARMONICS SUPPRESSION



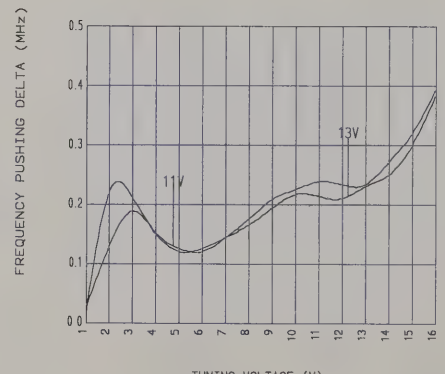

| | Harmonics (dBc) | | |
|---|---|---|---|
| | F2 | F3 | F4 |
| 1.0 | -40.4 | -38.2 | -48.7 |
| 2.0 | -46.4 | -40.8 | -46.6 |
| 3.0 | -58.4 | -40.9 | -44.5 |
| 4.0 | -50.3 | -39.8 | -43.4 |
| 5.0 | -45.6 | -38.6 | -42.5 |
| 6.0 | -43.4 | -37.4 | -41.5 |
| 7.0 | -42.6 | -36.2 | -40.5 |
| 8.0 | -43.1 | -35.0 | -39.6 |
| 9.0 | -44.7 | -34.1 | -38.7 |
| 10.0 | -48.5 | -33.1 | -38.3 |
| 11.0 | -53.8 | -32.5 | -38.1 |
| 12.0 | -54.9 | -31.8 | -37.7 |
| 13.0 | -51.1 | -31.5 | -37.4 |
| 14.0 | -48.0 | -30.9 | -37.3 |
| 15.0 | -46.2 | -30.6 | -37.3 |
| 16.0 | -44.6 | -30.2 | -37.3 |

### FREQ. VARIATION WITH TEMPERATURE



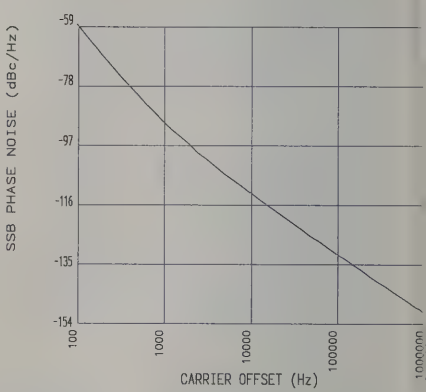

| | FREQUENCY(MHz) | | |
|---|---|---|---|
| V-TUNE | -55°C | +25°C | +85°C |
| 1.0 | 45.55 | 44.40 | 43.93 |
| 2.0 | 49.41 | 48.60 | 48.31 |
| 3.0 | 53.98 | 53.15 | 52.83 |
| 4.0 | 58.08 | 57.27 | 56.90 |
| 5.0 | 62.10 | 61.31 | 60.88 |
| 6.0 | 66.20 | 65.43 | 64.96 |
| 7.0 | 70.43 | 69.62 | 69.13 |
| 8.0 | 74.80 | 73.93 | 73.43 |
| 9.0 | 79.26 | 78.33 | 77.81 |
| 10.0 | 83.78 | 82.77 | 82.25 |
| 11.0 | 88.26 | 87.23 | 86.68 |
| 12.0 | 92.73 | 91.69 | 91.10 |
| 13.0 | 97.13 | 96.06 | 95.46 |
| 14.0 | 101.53 | 100.45 | 99.81 |
| 15.0 | 105.98 | 104.84 | 104.18 |
| 16.0 | 110.43 | 109.22 | 108.55 |

### FREQUENCY PUSHING




| | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) | |
|---|---|---|
| | 11V | 13V |
| 1.0 | 0.02 | 0.03 |
| 2.0 | 0.28 | 0.14 |
| 3.0 | 0.22 | 0.22 |
| 4.0 | 0.15 | 0.15 |
| 5.0 | 0.13 | 0.12 |
| 6.0 | 0.12 | 0.13 |
| 7.0 | 0.15 | 0.15 |
| 8.0 | 0.18 | 0.17 |
| 9.0 | 0.22 | 0.20 |
| 10.0 | 0.23 | 0.23 |
| 11.0 | 0.25 | 0.22 |
| 12.0 | 0.24 | 0.21 |
| 13.0 | 0.23 | 0.24 |
| 14.0 | 0.28 | 0.25 |
| 15.0 | 0.32 | 0.30 |
| 16.0 | 0.40 | 0.39 |

### PHASE NOISE




| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -59 |
| 1000 | -91 |
| 10000 | -112 |
| 100000 | -131 |
| 1000000 | -149 |

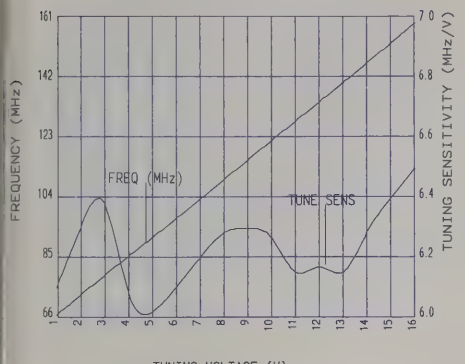


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## POS-150/JTOS-150

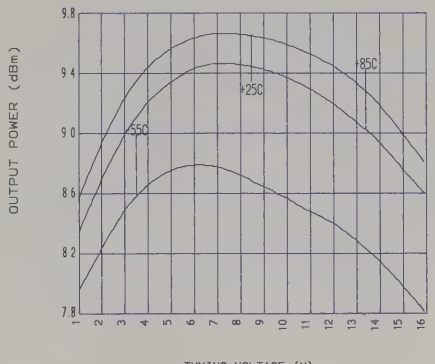
**75 to 150 MHz**

### TUNING CHARACTERISTICS



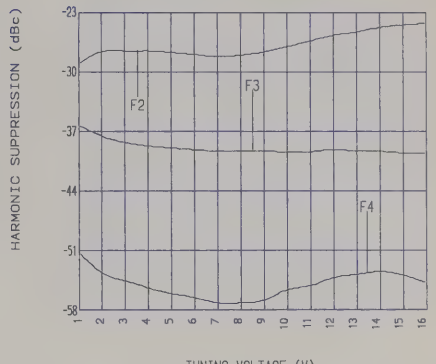

| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 66.6 | 6.1 |
| 2.0 | 72.9 | 6.3 |
| 3.0 | 79.4 | 6.5 |
| 4.0 | 85.4 | 6.0 |
| 5.0 | 91.4 | 6.0 |
| 6.0 | 97.5 | 6.1 |
| 7.0 | 103.7 | 6.2 |
| 8.0 | 110.0 | 6.3 |
| 9.0 | 116.3 | 6.3 |
| 10.0 | 122.6 | 6.3 |
| 11.0 | 128.7 | 6.1 |
| 12.0 | 134.9 | 6.2 |
| 13.0 | 141.0 | 6.1 |
| 14.0 | 147.4 | 6.3 |
| 15.0 | 153.7 | 6.4 |
| 16.0 | 160.2 | 6.5 |

### POWER OUTPUT



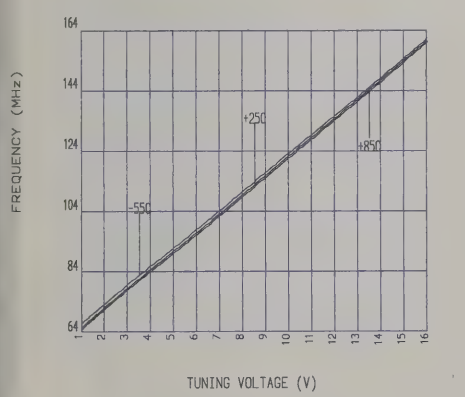

| | Pout (dBm) | | |
|---|---|---|---|
| V-TUNE | -55°C | +25°C | +85°C |
| 1.0 | 7.98 | 8.60 | 8.37 |
| 2.0 | 8.26 | 8.97 | 8.73 |
| 3.0 | 8.53 | 9.28 | 9.03 |
| 4.0 | 8.69 | 9.48 | 9.25 |
| 5.0 | 8.79 | 9.60 | 9.37 |
| 6.0 | 8.82 | 9.67 | 9.47 |
| 7.0 | 8.81 | 9.70 | 9.50 |
| 8.0 | 8.75 | 9.69 | 9.49 |
| 9.0 | 8.67 | 9.67 | 9.46 |
| 10.0 | 8.60 | 9.63 | 9.41 |
| 11.0 | 8.50 | 9.56 | 9.33 |
| 12.0 | 8.44 | 9.49 | 9.24 |
| 13.0 | 8.32 | 9.38 | 9.11 |
| 14.0 | 8.19 | 9.24 | 8.99 |
| 15.0 | 8.02 | 9.04 | 8.80 |
| 16.0 | 7.84 | 8.84 | 8.63 |

### HARMONICS SUPPRESSION



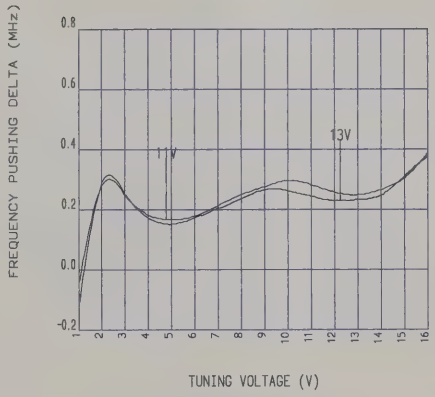

| | Harmonics (dBc) | | |
|---|---|---|---|
| V-TUNE | F2 | F3 | F4 |
| 1.0 | -28.4 | -35.8 | -50.8 |
| 2.0 | -26.7 | -37.2 | -53.5 |
| 3.0 | -27.1 | -37.8 | -53.9 |
| 4.0 | -26.9 | -38.2 | -54.9 |
| 5.0 | -27.2 | -38.4 | -55.5 |
| 6.0 | -27.4 | -38.6 | -55.9 |
| 7.0 | -27.8 | -38.8 | -56.7 |
| 8.0 | -27.5 | -38.8 | -56.5 |
| 9.0 | -27.2 | -38.7 | -56.5 |
| 10.0 | -26.5 | -38.9 | -54.7 |
| 11.0 | -25.9 | -38.9 | -54.8 |
| 12.0 | -25.1 | -38.5 | -53.4 |
| 13.0 | -24.9 | -38.8 | -53.3 |
| 14.0 | -24.2 | -38.7 | -52.7 |
| 15.0 | -24.0 | -39.0 | -53.2 |
| 16.0 | -23.8 | -39.0 | -54.1 |

### FREQ. VARIATION WITH TEMPERATURE



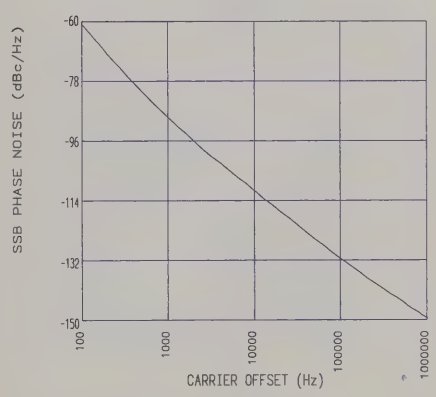

| | FREQUENCY(MHz) | | |
|---|---|---|---|
| V-TUNE | -55°C | +25°C | +85°C |
| 1.0 | 66.63 | 65.35 | 64.63 |
| 2.0 | 72.93 | 71.66 | 71.18 |
| 3.0 | 79.40 | 78.21 | 77.65 |
| 4.0 | 85.40 | 84.28 | 83.65 |
| 5.0 | 91.36 | 90.28 | 89.62 |
| 6.0 | 97.45 | 96.38 | 95.70 |
| 7.0 | 103.66 | 102.60 | 101.92 |
| 8.0 | 110.00 | 108.93 | 108.25 |
| 9.0 | 116.31 | 115.30 | 114.62 |
| 10.0 | 122.58 | 121.62 | 120.93 |
| 11.0 | 128.71 | 127.81 | 127.16 |
| 12.0 | 134.91 | 134.06 | 133.41 |
| 13.0 | 141.03 | 140.28 | 139.66 |
| 14.0 | 147.35 | 146.58 | 146.00 |
| 15.0 | 153.73 | 153.01 | 152.43 |
| 16.0 | 160.21 | 159.51 | 158.95 |

### FREQUENCY PUSHING




| | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) | |
|---|---|---|
| V-TUNE | 11V | 13V |
| 1.0 | -0.04 | -0.11 |
| 2.0 | 0.37 | 0.40 |
| 3.0 | 0.23 | 0.23 |
| 4.0 | 0.17 | 0.16 |
| 5.0 | 0.16 | 0.14 |
| 6.0 | 0.17 | 0.17 |
| 7.0 | 0.21 | 0.20 |
| 8.0 | 0.25 | 0.23 |
| 9.0 | 0.27 | 0.27 |
| 10.0 | 0.30 | 0.26 |
| 11.0 | 0.28 | 0.24 |
| 12.0 | 0.25 | 0.22 |
| 13.0 | 0.24 | 0.23 |
| 14.0 | 0.26 | 0.23 |
| 15.0 | 0.29 | 0.31 |
| 16.0 | 0.38 | 0.37 |

### PHASE NOISE




| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -60 |
| 1000 | -89 |
| 10000 | -109 |
| 100000 | -127 |
| 1000000 | 147 |

CAPO now available! computer-automated performance data

In Stock... Immediate Delivery

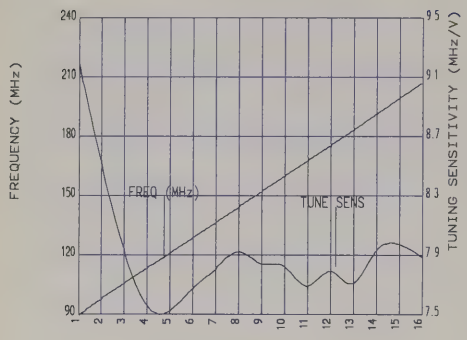
For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

## POS-200/JTOS-200

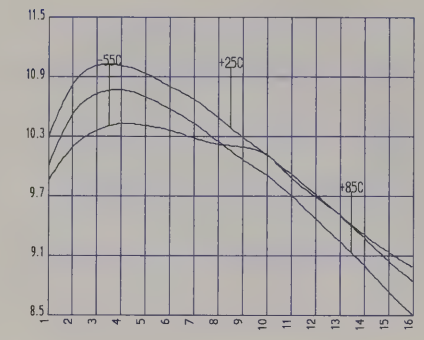
**100 to 200 MHz**

### TUNING CHARACTERISTICS



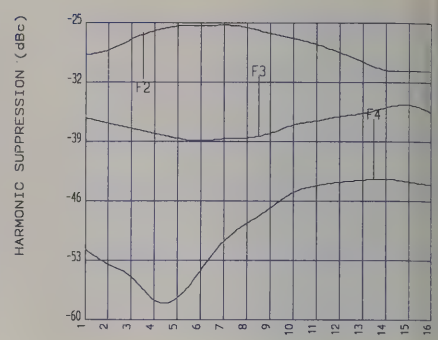

| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 90.1 | 9.2 |
| 2.0 | 98.7 | 8.5 |
| 3.0 | 106.6 | 7.9 |
| 4.0 | 114.1 | 7.5 |
| 5.0 | 121.6 | 7.5 |
| 6.0 | 129.3 | 7.7 |
| 7.0 | 137.1 | 7.8 |
| 8.0 | 145.1 | 8.0 |
| 9.0 | 153.0 | 7.8 |
| 10.0 | 160.8 | 7.9 |
| 11.0 | 168.5 | 7.6 |
| 12.0 | 176.4 | 7.9 |
| 13.0 | 184.0 | 7.6 |
| 14.0 | 192.0 | 8.0 |
| 15.0 | 200.0 | 8.0 |
| 16.0 | 207.9 | 7.9 |

### POWER OUTPUT



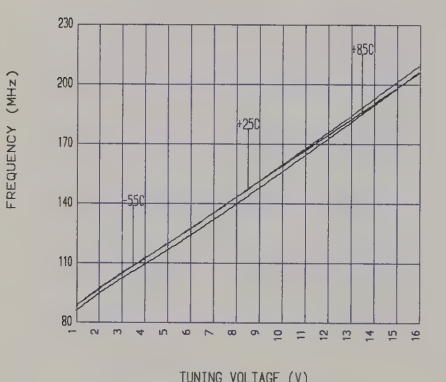

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| 1.0 | 9.87 | 10.31 | 10.02 |
| 2.0 | 10.25 | 10.92 | 10.61 |
| 3.0 | 10.39 | 11.06 | 10.77 |
| 4.0 | 10.47 | 11.05 | 10.81 |
| 5.0 | 10.43 | 10.97 | 10.73 |
| 6.0 | 10.39 | 10.82 | 10.60 |
| 7.0 | 10.30 | 10.71 | 10.46 |
| 8.0 | 10.23 | 10.51 | 10.27 |
| 9.0 | 10.22 | 10.31 | 10.08 |
| 10.0 | 10.17 | 10.14 | 9.94 |
| 11.0 | 9.89 | 9.94 | 9.73 |
| 12.0 | 9.71 | 9.73 | 9.49 |
| 13.0 | 9.54 | 9.53 | 9.26 |
| 14.0 | 9.32 | 9.30 | 9.03 |
| 15.0 | 9.15 | 9.06 | 8.75 |
| 16.0 | 9.00 | 8.86 | 8.52 |

### HARMONICS SUPPRESSION



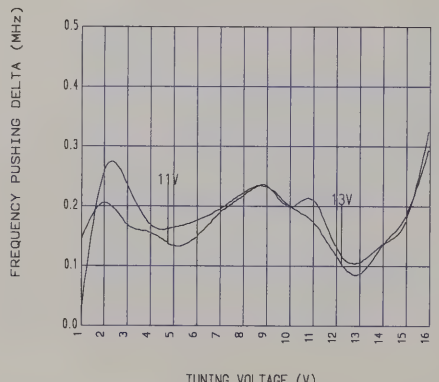

| | Harmonics (dBc) | | |
|---|---|---|---|
| | F2 | F3 | F4 |
| 1.0 | -28.6 | -36.0 | -51.5 |
| 2.0 | -28.3 | -36.7 | -53.5 |
| 3.0 | -26.7 | -37.3 | -54.2 |
| 4.0 | -25.7 | -37.9 | -58.2 |
| 5.0 | -25.1 | -38.5 | -57.9 |
| 6.0 | -25.3 | -38.9 | -54.1 |
| 7.0 | -25.0 | -38.4 | -50.3 |
| 8.0 | -25.3 | -38.5 | -48.5 |
| 9.0 | -26.1 | -38.0 | -46.8 |
| 10.0 | -26.6 | -36.7 | -44.6 |
| 11.0 | -27.3 | -36.5 | -44.0 |
| 12.0 | -28.3 | -35.8 | -43.6 |
| 13.0 | -29.3 | -35.6 | -43.4 |
| 14.0 | -30.7 | -34.8 | -43.1 |
| 15.0 | -30.4 | -34.2 | -43.6 |
| 16.0 | -30.5 | -35.3 | -43.9 |

### FREQ. VARIATION WITH TEMPERATURE



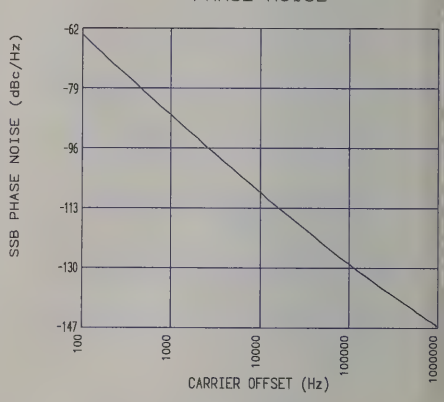

| | FREQUENCY(MHz) | | |
|---|---|---|---|
| V-TUNE | -55°C | +25°C | +85°C |
| 1.0 | 90.26 | 90.12 | 87.80 |
| 2.0 | 99.05 | 98.66 | 96.63 |
| 3.0 | 106.85 | 106.58 | 104.12 |
| 4.0 | 114.18 | 114.08 | 111.21 |
| 5.0 | 121.53 | 121.62 | 118.38 |
| 6.0 | 129.06 | 129.30 | 125.81 |
| 7.0 | 136.93 | 137.10 | 133.58 |
| 8.0 | 145.12 | 145.10 | 141.55 |
| 9.0 | 153.05 | 152.95 | 149.75 |
| 10.0 | 161.31 | 160.83 | 157.85 |
| 11.0 | 169.31 | 168.47 | 166.06 |
| 12.0 | 177.63 | 176.36 | 174.38 |
| 13.0 | 185.60 | 183.96 | 182.60 |
| 14.0 | 194.50 | 191.96 | 191.25 |
| 15.0 | 202.95 | 200.00 | 199.71 |
| 16.0 | 211.21 | 207.87 | 208.18 |

### FREQUENCY PUSHING




| FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) | | |
|---|---|---|
| | 11V | 13V |
| 1.0 | 0.15 | 0.03 |
| 2.0 | 0.24 | 0.33 |
| 3.0 | 0.16 | 0.24 |
| 4.0 | 0.17 | 0.16 |
| 5.0 | 0.13 | 0.17 |
| 6.0 | 0.15 | 0.18 |
| 7.0 | 0.20 | 0.20 |
| 8.0 | 0.22 | 0.23 |
| 9.0 | 0.26 | 0.25 |
| 10.0 | 0.18 | 0.20 |
| 11.0 | 0.25 | 0.19 |
| 12.0 | 0.12 | 0.12 |
| 13.0 | 0.10 | 0.07 |
| 14.0 | 0.15 | 0.15 |
| 15.0 | 0.15 | 0.17 |
| 16.0 | 0.33 | 0.30 |

### PHASE NOISE




| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -62 |
| 1000 | -85 |
| 10000 | -107 |
| 100000 | -128 |
| 1000000 | -145 |

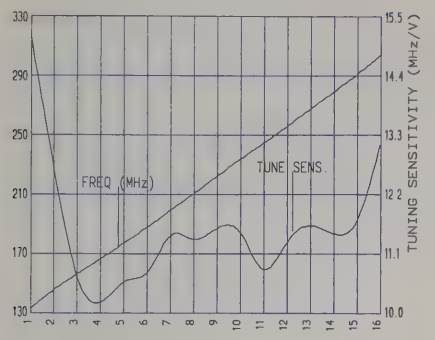


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

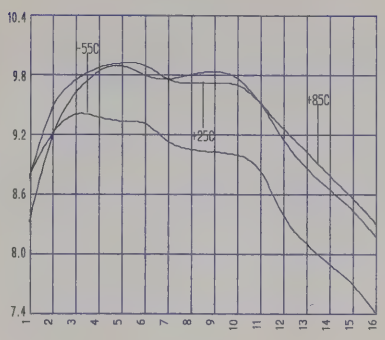
## POS-300/JTOS-300

**150 to 280 MHz**

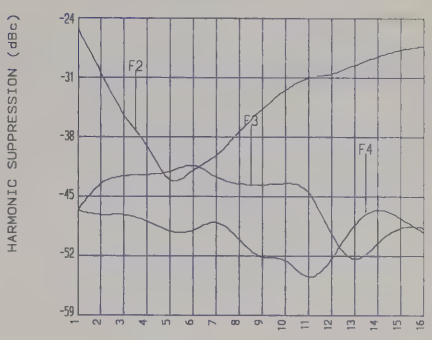
TUNING CHARACTERISTICS




POWER OUTPUT

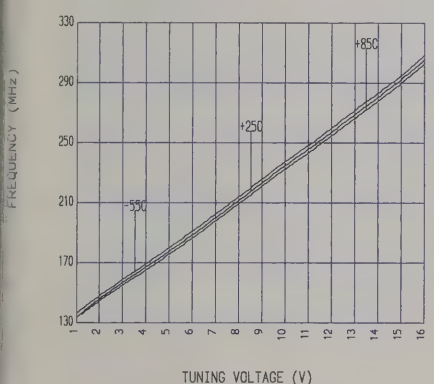



HARMONICS SUPPRESSION

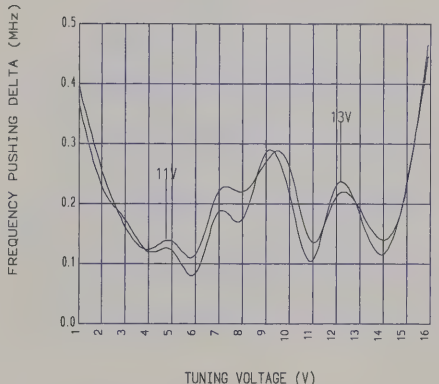



| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY | Pout (dBm) -55°C | Pout (dBm) +25°C | Pout (dBm) +85°C | Harmonics (dBc) F2 | Harmonics (dBc) F3 | Harmonics (dBc) F4 |
|---|---|---|---|---|---|---|---|---|
| 1.0 | 136.0 | 15.2 | 8.84 | 8.81 | 8.37 | -24.6 | -46.3 | -46.3 |
| 2.0 | 148.7 | 12.7 | 9.31 | 9.63 | 9.34 | -29.7 | -42.6 | -47.0 |
| 3.0 | 159.1 | 10.4 | 9.51 | 9.82 | 9.70 | -35.4 | -42.1 | -46.6 |
| 4.0 | 169.2 | 10.1 | 9.43 | 9.96 | 9.93 | -38.0 | -42.0 | -47.5 |
| 5.0 | 180.1 | 10.8 | 9.38 | 9.99 | 9.99 | -44.2 | -41.9 | -49.0 |
| 6.0 | 190.7 | 10.6 | 9.42 | 10.00 | 9.85 | -41.2 | -40.3 | -49.0 |
| 7.0 | 202.5 | 11.8 | 9.15 | 9.79 | 9.80 | -40.1 | -42.6 | -46.9 |
| 8.0 | 213.8 | 11.3 | 9.10 | 9.78 | 9.88 | -36.8 | -43.2 | -49.8 |
| 9.0 | 225.5 | 11.7 | 9.08 | 9.79 | 9.91 | -34.1 | -43.3 | -52.5 |
| 10.0 | 237.4 | 11.8 | 9.06 | 9.79 | 9.88 | -31.8 | -43.0 | -51.4 |
| 11.0 | 247.8 | 10.5 | 8.97 | 9.62 | 9.58 | -30.2 | -43.1 | -55.4 |
| 12.0 | 259.3 | 11.5 | 8.38 | 9.18 | 9.31 | -30.2 | -49.5 | -52.4 |
| 13.0 | 271.1 | 11.8 | 8.14 | 8.91 | 9.09 | -28.9 | -53.2 | -47.7 |
| 14.0 | 282.6 | 11.5 | 7.93 | 8.69 | 8.83 | -27.9 | -50.1 | -45.6 |
| 15.0 | 294.2 | 11.5 | 7.75 | 8.50 | 8.62 | -27.0 | -48.0 | -47.2 |
| 16.0 | 307.4 | 13.2 | 7.44 | 8.22 | 8.35 | -26.7 | -48.4 | -48.9 |

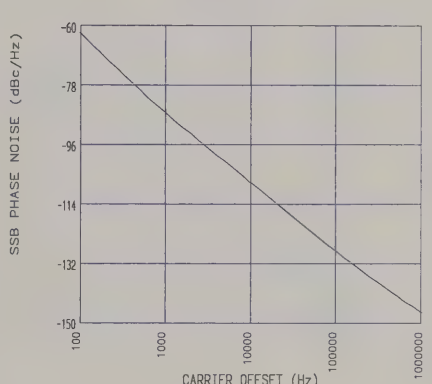
FREQ. VARIATION WITH TEMPERATURE




FREQUENCY PUSHING




PHASE NOISE




| V-TUNE | FREQUENCY(MHz) -55°C | FREQUENCY(MHz) +25°C | FREQUENCY(MHz) +85°C |
|---|---|---|---|
| 1.0 | 138.58 | 136.00 | 135.70 |
| 2.0 | 150.61 | 148.68 | 147.15 |
| 3.0 | 161.06 | 159.08 | 157.38 |
| 4.0 | 171.65 | 169.21 | 167.46 |
| 5.0 | 182.25 | 180.05 | 177.96 |
| 6.0 | 193.33 | 190.70 | 188.70 |
| 7.0 | 204.78 | 202.46 | 200.30 |
| 8.0 | 216.40 | 213.80 | 211.48 |
| 9.0 | 227.96 | 225.50 | 223.48 |
| 10.0 | 240.03 | 237.35 | 234.88 |
| 11.0 | 250.31 | 247.82 | 245.40 |
| 12.0 | 261.96 | 259.30 | 256.93 |
| 13.0 | 274.03 | 271.13 | 268.48 |
| 14.0 | 285.33 | 282.63 | 279.91 |
| 15.0 | 296.50 | 294.15 | 291.66 |
| 16.0 | 310.38 | 307.38 | 304.65 |

| FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) 11V | 13V |
|---|---|
| 0.37 | 0.40 |
| 0.21 | 0.25 |
| 0.19 | 0.16 |
| 0.10 | 0.11 |
| 0.16 | 0.17 |
| 0.03 | 0.07 |
| 0.25 | 0.27 |
| 0.12 | 0.20 |
| 0.34 | 0.28 |
| 0.25 | 0.32 |
| 0.03 | 0.07 |
| 0.29 | 0.25 |
| 0.20 | 0.21 |
| 0.08 | 0.12 |
| 0.20 | 0.18 |
| 0.45 | 0.47 |

| PHASE NOISE CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -60 |
| 1000 | -85 |
| 10000 | -105 |
| 100000 | -127 |
| 1000000 | -145 |

CAPO now available! computer-automated performance data

In Stock... Immediate Delivery

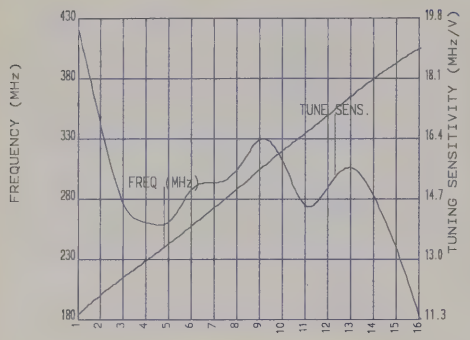
For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

## POS-400/JTOS-400

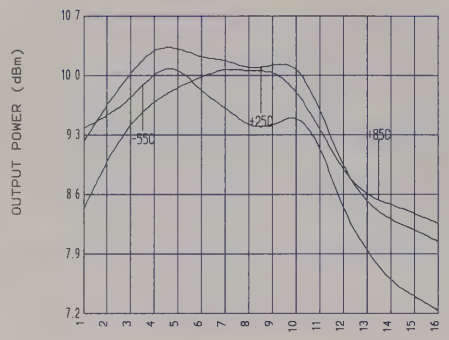
**200 to 380 MHz**

### TUNING CHARACTERISTICS



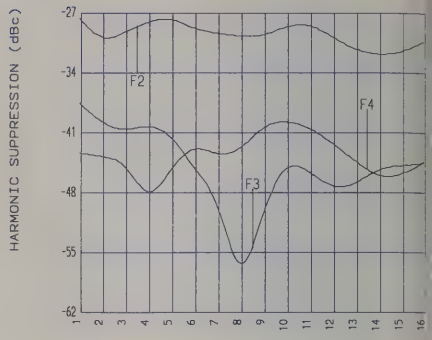

| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 184.88 | 19.5 |
| 2.0 | 201.58 | 16.7 |
| 3.0 | 215.71 | 14.1 |
| 4.0 | 229.83 | 14.1 |
| 5.0 | 243.63 | 13.8 |
| 6.0 | 258.88 | 15.3 |
| 7.0 | 273.95 | 15.1 |
| 8.0 | 289.35 | 15.4 |
| 9.0 | 306.18 | 16.8 |
| 10.0 | 322.08 | 15.9 |
| 11.0 | 336.13 | 14.0 |
| 12.0 | 351.32 | 15.2 |
| 13.0 | 367.18 | 15.9 |
| 14.0 | 382.00 | 14.8 |
| 15.0 | 395.30 | 13.3 |
| 16.0 | 406.65 | 11.3 |

### POWER OUTPUT



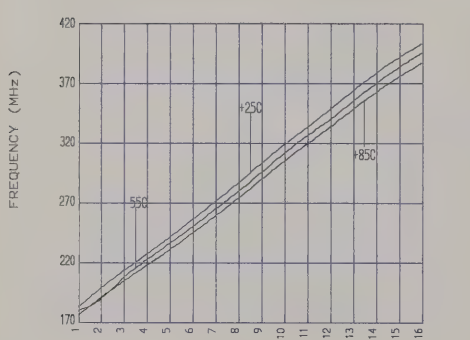

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| 1.0 | 9.43 | 9.27 | 8.47 |
| 2.0 | 9.57 | 9.71 | 9.06 |
| 3.0 | 9.77 | 10.08 | 9.49 |
| 4.0 | 10.10 | 10.39 | 9.75 |
| 5.0 | 10.17 | 10.38 | 9.91 |
| 6.0 | 9.84 | 10.25 | 10.03 |
| 7.0 | 9.68 | 10.24 | 10.14 |
| 8.0 | 9.43 | 10.11 | 10.09 |
| 9.0 | 9.44 | 10.17 | 10.12 |
| 10.0 | 9.63 | 10.21 | 9.89 |
| 11.0 | 9.27 | 9.67 | 9.42 |
| 12.0 | 8.43 | 8.94 | 8.91 |
| 13.0 | 7.99 | 8.54 | 8.63 |
| 14.0 | 7.61 | 8.35 | 8.53 |
| 15.0 | 7.46 | 8.23 | 8.43 |
| 16.0 | 7.29 | 8.10 | 8.31 |

### HARMONICS SUPPRESSION



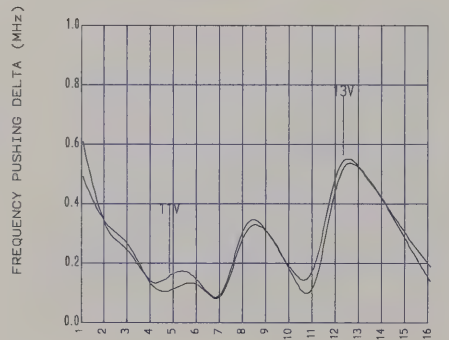

| | Harmonics (dBc) | | |
|---|---|---|---|
| | F2 | F3 | F4 |
| 1.0 | -27.2 | -37.1 | -42.9 |
| 2.0 | -30.1 | -39.5 | -43.3 |
| 3.0 | -28.7 | -40.5 | -43.8 |
| 4.0 | -27.5 | -39.4 | -49.1 |
| 5.0 | -27.0 | -40.7 | -44.4 |
| 6.0 | -28.5 | -44.9 | -41.8 |
| 7.0 | -28.9 | -47.8 | -43.3 |
| 8.0 | -29.3 | -59.5 | -42.7 |
| 9.0 | -29.3 | -49.0 | -39.5 |
| 10.0 | -28.0 | -43.5 | -39.1 |
| 11.0 | -27.7 | -45.1 | -39.9 |
| 12.0 | -29.4 | -47.2 | -41.8 |
| 13.0 | -30.9 | -46.6 | -43.9 |
| 14.0 | -31.5 | -44.6 | -45.9 |
| 15.0 | -31.2 | -44.4 | -45.5 |
| 16.0 | -29.9 | -44.1 | -44.0 |

### FREQ. VARIATION WITH TEMPERATURE



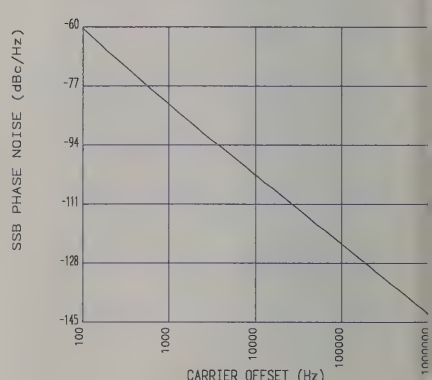

| V-TUNE | FREQUENCY(MHz) -55°C | +25°C | +85°C |
|---|---|---|---|
| 1.0 | 181.60 | 184.88 | 178.08 |
| 2.0 | 189.70 | 201.58 | 193.38 |
| 3.0 | 211.25 | 215.71 | 207.00 |
| 4.0 | 224.98 | 229.83 | 220.17 |
| 5.0 | 238.65 | 243.63 | 233.22 |
| 6.0 | 252.53 | 258.88 | 247.43 |
| 7.0 | 267.80 | 273.95 | 261.75 |
| 8.0 | 282.13 | 289.35 | 276.48 |
| 9.0 | 298.35 | 306.18 | 292.55 |
| 10.0 | 314.65 | 322.08 | 308.05 |
| 11.0 | 329.68 | 336.13 | 322.25 |
| 12.0 | 342.40 | 351.32 | 336.42 |
| 13.0 | 358.26 | 367.18 | 351.48 |
| 14.0 | 373.38 | 382.00 | 365.85 |
| 15.0 | 386.98 | 395.30 | 378.86 |
| 16.0 | 398.75 | 406.65 | 390.35 |

### FREQUENCY PUSHING




| V-TUNE | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) 11V | 13V |
|---|---|---|
| 1.0 | 0.62 | 0.50 |
| 2.0 | 0.28 | 0.32 |
| 3.0 | 0.28 | 0.30 |
| 4.0 | 0.10 | 0.10 |
| 5.0 | 0.20 | 0.12 |
| 6.0 | 0.17 | 0.17 |
| 7.0 | 0.02 | 0.02 |
| 8.0 | 0.41 | 0.37 |
| 9.0 | 0.32 | 0.33 |
| 10.0 | 0.18 | 0.18 |
| 11.0 | 0.10 | 0.02 |
| 12.0 | 0.62 | 0.58 |
| 13.0 | 0.53 | 0.54 |
| 14.0 | 0.42 | 0.42 |
| 15.0 | 0.30 | 0.28 |
| 16.0 | 0.20 | 0.15 |

### PHASE NOISE




| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -60 |
| 1000 | -82 |
| 10000 | -102 |
| 100000 | -122 |
| 1000000 | -142 |

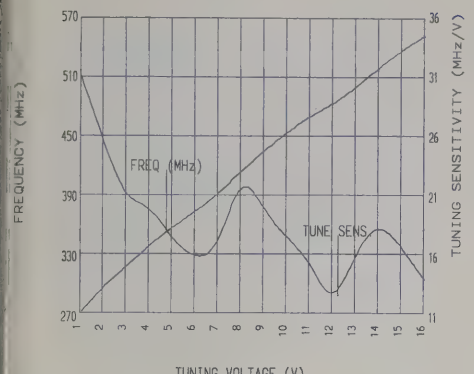


Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## POS-535/JTOS-535

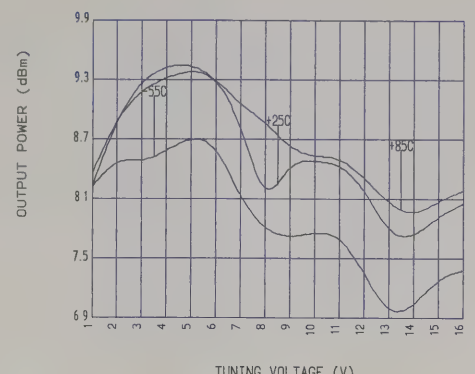
**300 to 525 MHz**

### TUNING CHARACTERISTICS



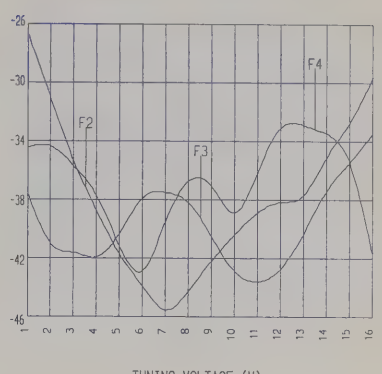

| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 278.9 | 31.5 |
| 2.0 | 304.9 | 26.0 |
| 3.0 | 325.8 | 20.9 |
| 4.0 | 346.7 | 20.9 |
| 5.0 | 364.5 | 17.8 |
| 6.0 | 380.7 | 16.2 |
| 7.0 | 397.5 | 16.8 |
| 8.0 | 421.3 | 23.9 |
| 9.0 | 441.6 | 20.3 |
| 10.0 | 459.6 | 18.0 |
| 11.0 | 476.0 | 16.3 |
| 12.0 | 487.9 | 11.9 |
| 13.0 | 504.8 | 16.8 |
| 14.0 | 524.4 | 19.6 |
| 15.0 | 541.7 | 17.3 |
| 16.0 | 556.3 | 14.6 |

### POWER OUTPUT



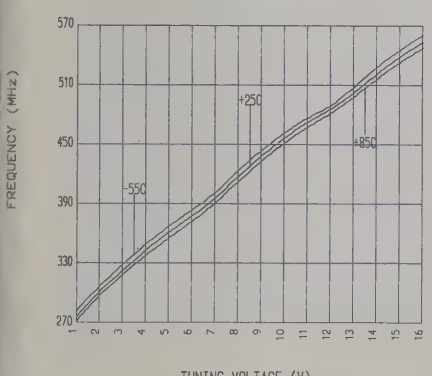

| | Pout (dBm) | | |
|---|---|---|---|
| | -55°C | +25°C | +85°C |
| 1.0 | 8.25 | 8.38 | 8.25 |
| 2.0 | 8.55 | 8.95 | 8.94 |
| 3.0 | 8.49 | 9.23 | 9.33 |
| 4.0 | 8.61 | 9.35 | 9.47 |
| 5.0 | 8.76 | 9.43 | 9.49 |
| 6.0 | 8.70 | 9.37 | 9.34 |
| 7.0 | 8.12 | 8.91 | 9.07 |
| 8.0 | 7.81 | 8.00 | 8.91 |
| 9.0 | 7.73 | 8.53 | 8.63 |
| 10.0 | 7.80 | 8.51 | 8.55 |
| 11.0 | 7.78 | 8.49 | 8.56 |
| 12.0 | 7.40 | 8.25 | 8.35 |
| 13.0 | 6.94 | 7.76 | 8.08 |
| 14.0 | 7.04 | 7.73 | 7.95 |
| 15.0 | 7.34 | 7.96 | 8.11 |
| 16.0 | 7.41 | 8.08 | 8.21 |

### HARMONICS SUPPRESSION



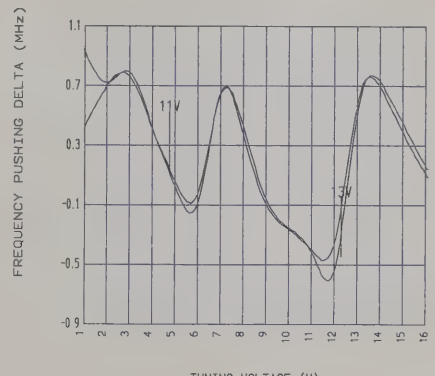

| | Harmonics (dBc) | | |
|---|---|---|---|
| | F2 | F3 | F4 |
| 1.0 | -26.6 | -37.3 | -34.1 |
| 2.0 | -30.9 | -41.3 | -33.7 |
| 3.0 | -35.3 | -40.9 | -35.4 |
| 4.0 | -38.4 | -41.9 | -37.0 |
| 5.0 | -41.5 | -40.0 | -41.0 |
| 6.0 | -43.3 | -36.9 | -43.6 |
| 7.0 | -45.7 | -37.1 | -38.6 |
| 8.0 | -43.7 | -37.4 | -35.8 |
| 9.0 | -41.6 | -40.1 | -36.2 |
| 10.0 | -39.9 | -42.7 | -39.7 |
| 11.0 | -38.3 | -43.3 | -35.7 |
| 12.0 | -37.6 | -42.5 | -32.1 |
| 13.0 | -37.9 | -40.0 | -32.6 |
| 14.0 | -34.5 | -36.7 | -33.1 |
| 15.0 | -32.7 | -35.2 | -34.0 |
| 16.0 | -29.5 | -33.2 | -41.1 |

### FREQ. VARIATION WITH TEMPERATURE



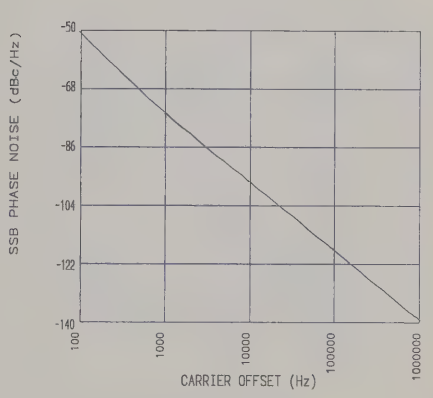

| | FREQUENCY(MHz) | | |
|---|---|---|---|
| V-TUNE | -55°C | +25°C | +85°C |
| 1.0 | 285.03 | 278.9 | 274.76 |
| 2.0 | 310.18 | 304.9 | 301.16 |
| 3.0 | 331.32 | 325.8 | 321.53 |
| 4.0 | 352.76 | 346.7 | 341.31 |
| 5.0 | 370.65 | 364.5 | 358.75 |
| 6.0 | 386.75 | 380.7 | 374.87 |
| 7.0 | 402.92 | 397.5 | 393.16 |
| 8.0 | 427.07 | 421.3 | 416.08 |
| 9.0 | 446.98 | 441.6 | 436.50 |
| 10.0 | 464.80 | 459.6 | 454.75 |
| 11.0 | 480.78 | 476.0 | 471.03 |
| 12.0 | 490.28 | 487.9 | 483.67 |
| 13.0 | 511.07 | 504.8 | 500.43 |
| 14.0 | 531.23 | 524.4 | 519.33 |
| 15.0 | 548.65 | 541.7 | 536.06 |
| 16.0 | 563.30 | 556.3 | 550.38 |

### FREQUENCY PUSHING




| | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) | |
|---|---|---|
| | 11V | 13V |
| 1.0 | 0.97 | 0.44 |
| 2.0 | 0.64 | 0.75 |
| 3.0 | 0.97 | 0.90 |
| 4.0 | 0.41 | 0.41 |
| 5.0 | 0.07 | 0.09 |
| 6.0 | -0.36 | -0.25 |
| 7.0 | 1.04 | 0.97 |
| 8.0 | 0.35 | 0.45 |
| 9.0 | -0.14 | -0.12 |
| 10.0 | -0.23 | -0.23 |
| 11.0 | -0.37 | -0.33 |
| 12.0 | -0.58 | -0.87 |
| 13.0 | 0.93 | 0.92 |
| 14.0 | 0.73 | 0.77 |
| 15.0 | 0.38 | 0.45 |
| 16.0 | 0.12 | 0.17 |

### PHASE NOISE




| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -50 |
| 1000 | -75 |
| 10000 | -95 |
| 100000 | -116 |
| 1000000 | -137 |

CAPO now available! computer-automated performance data

**In Stock... Immediate Delivery**

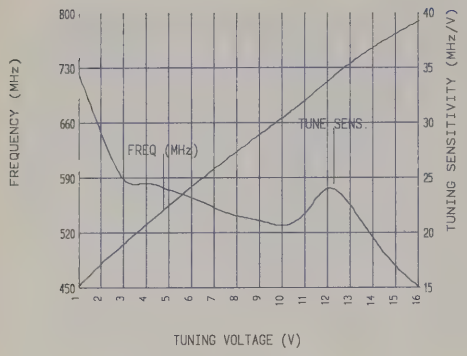
For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

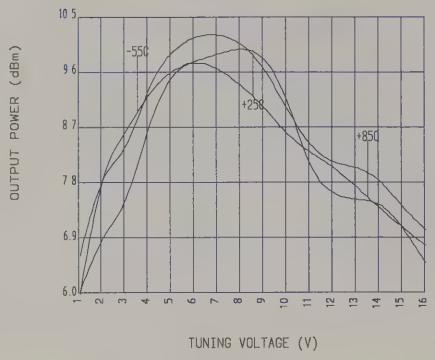
## POS-765/JTOS-765

**485 to 765 MHz**

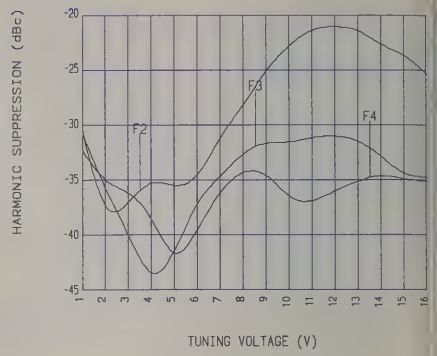
TUNING CHARACTERISTICS




POWER OUTPUT

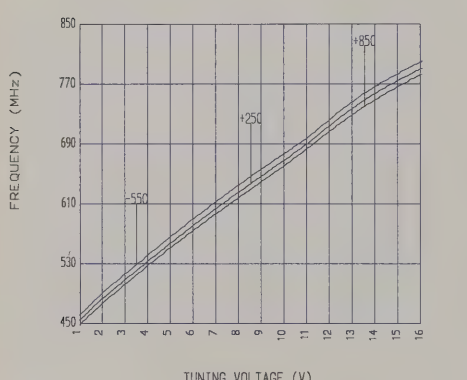



HARMONICS SUPPRESSION

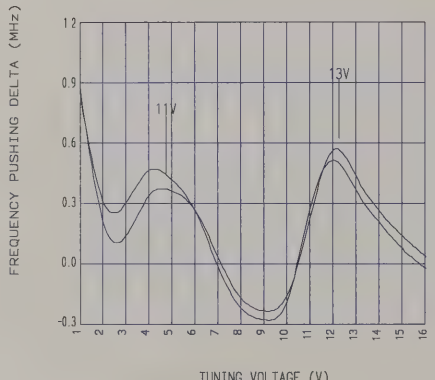



| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY | Pout (dBm) -55°C | Pout (dBm) +25°C | Pout (dBm) +85°C | Harmonics (dBc) F2 | Harmonics (dBc) F3 | Harmonics (dBc) F4 |
|---|---|---|---|---|---|---|---|---|
| 1.0 | 458.58 | 35.0 | 6.03 | 6.65 | 6.07 | -30.2 | -30.5 | -32.0 |
| 2.0 | 488.18 | 29.6 | 8.15 | 8.08 | 7.02 | -38.7 | -35.6 | -35.1 |
| 3.0 | 512.46 | 24.3 | 8.63 | 8.25 | 7.39 | -36.8 | -39.5 | -35.6 |
| 4.0 | 537.73 | 25.3 | 9.31 | 9.46 | 8.82 | -34.4 | -44.4 | -37.8 |
| 5.0 | 562.06 | 24.3 | 9.66 | 9.98 | 9.64 | -35.5 | -41.4 | -42.7 |
| 6.0 | 585.85 | 23.8 | 9.80 | 10.21 | 9.82 | -34.8 | -36.3 | -39.2 |
| 7.0 | 608.52 | 22.7 | 9.91 | 10.25 | 9.69 | -30.6 | -34.4 | -35.5 |
| 8.0 | 630.40 | 21.9 | 10.03 | 10.11 | 9.41 | -28.0 | -32.1 | -33.7 |
| 9.0 | 652.12 | 21.7 | 9.92 | 9.71 | 9.06 | -24.6 | -31.2 | -33.9 |
| 10.0 | 672.95 | 20.8 | 9.24 | 9.00 | 8.59 | -22.5 | -31.4 | -36.6 |
| 11.0 | 694.83 | 21.9 | 7.96 | 8.39 | 8.31 | -20.9 | -30.8 | -36.8 |
| 12.0 | 720.38 | 25.5 | 7.62 | 8.13 | 8.09 | -20.8 | -30.7 | -35.6 |
| 13.0 | 743.41 | 23.0 | 7.54 | 8.09 | 7.76 | -21.0 | -31.0 | -34.8 |
| 14.0 | 763.22 | 19.8 | 7.54 | 7.90 | 7.41 | -22.6 | -32.6 | -34.1 |
| 15.0 | 780.43 | 17.2 | 7.12 | 7.42 | 7.10 | -23.3 | -34.4 | -34.7 |
| 16.0 | 795.96 | 15.5 | 6.53 | 7.07 | 6.81 | -25.1 | -34.4 | -34.8 |

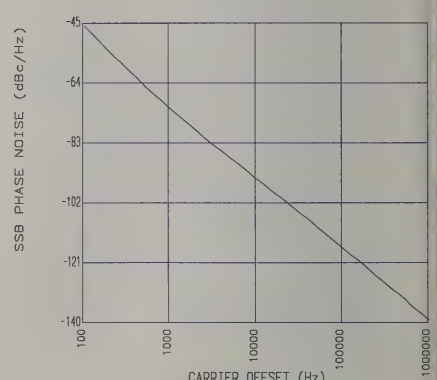
FREQ. VARIATION WITH TEMPERATURE




FREQUENCY PUSHING




PHASE NOISE




| V-TUNE | FREQUENCY(MHz) -55°C | FREQUENCY(MHz) +25°C | FREQUENCY(MHz) +85°C | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) 11V | FREQUENCY PUSHING (MHz) (REFERRED TO Vcc=12V) 13V |
|---|---|---|---|---|---|
| 1.0 | 465.25 | 458.58 | 452.66 | 0.88 | 0.92 |
| 2.0 | 495.97 | 488.18 | 481.77 | 0.21 | 0.10 |
| 3.0 | 520.33 | 512.46 | 506.55 | 0.29 | 0.10 |
| 4.0 | 545.93 | 537.73 | 531.95 | 0.54 | 0.41 |
| 5.0 | 570.77 | 562.06 | 556.06 | 0.44 | 0.39 |
| 6.0 | 594.83 | 585.85 | 579.35 | 0.32 | 0.32 |
| 7.0 | 617.68 | 608.52 | 601.52 | -0.02 | 0.04 |
| 8.0 | 640.03 | 630.40 | 623.18 | -0.24 | -0.19 |
| 9.0 | 661.98 | 652.12 | 644.62 | -0.27 | -0.23 |
| 10.0 | 681.98 | 672.95 | 665.68 | -0.28 | -0.22 |
| 11.0 | 702.20 | 694.83 | 688.36 | 0.36 | 0.25 |
| 12.0 | 728.47 | 720.38 | 712.66 | 0.62 | 0.71 |
| 13.0 | 752.52 | 743.41 | 734.83 | 0.36 | 0.43 |
| 14.0 | 772.63 | 763.22 | 754.73 | 0.22 | 0.27 |
| 15.0 | 789.40 | 780.43 | 772.20 | 0.08 | 0.15 |
| 16.0 | 804.72 | 795.96 | 787.93 | -0.01 | 0.05 |

| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -46 |
| 1000 | -74 |
| 10000 | -95 |
| 100000 | -117 |
| 1000000 | -140 |



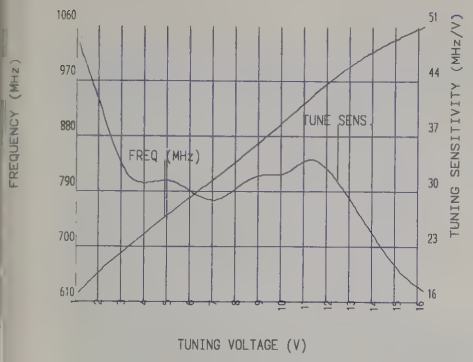
Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# VOLTAGE CONTROLLED OSCILLATORS

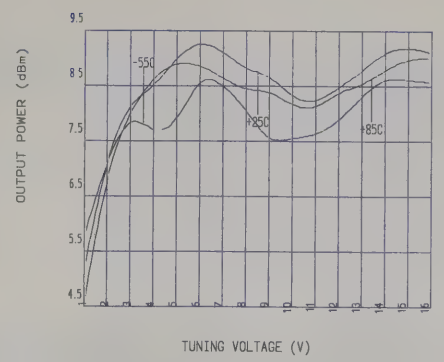
## POS-1025/JTOS-1025

**685 to 1025 MHz**

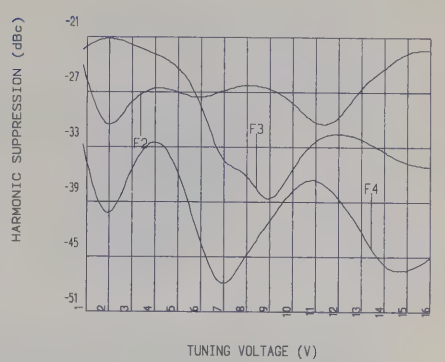
TUNING CHARACTERISTICS




POWER OUTPUT




HARMONICS SUPPRESSION

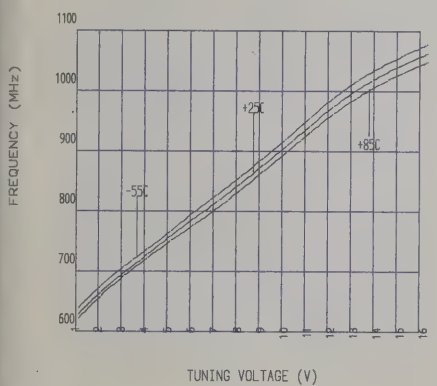



| V-TUNE | FREQUENCY (MHz) | TUNING SENSITIVITY |
|---|---|---|
| 1.0 | 616.50 | 48.0 |
| 2.0 | 656.40 | 39.9 |
| 3.0 | 686.95 | 30.6 |
| 4.0 | 717.23 | 30.3 |
| 5.0 | 748.42 | 31.2 |
| 6.0 | 777.42 | 29.0 |
| 7.0 | 805.13 | 27.7 |
| 8.0 | 835.47 | 30.3 |
| 9.0 | 867.33 | 31.9 |
| 10.0 | 898.35 | 31.0 |
| 11.0 | 932.78 | 34.4 |
| 12.0 | 964.68 | 31.9 |
| 13.0 | 992.13 | 27.5 |
| 14.0 | 1015.10 | 23.0 |
| 15.0 | 1034.03 | 18.9 |
| 16.0 | 1050.93 | 16.9 |

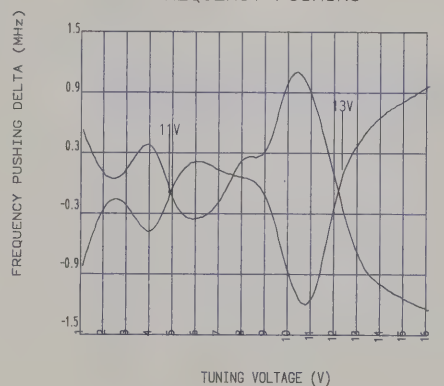
| Pout (dBm) | | |
|---|---|---|
| -55°C | +25°C | +85°C |
| 5.72 | 5.15 | 4.56 |
| 7.12 | 7.25 | 6.98 |
| 7.91 | 8.11 | 7.97 |
| 7.45 | 8.34 | 8.55 |
| 7.68 | 8.91 | 8.81 |
| 8.61 | 9.19 | 8.74 |
| 8.39 | 8.99 | 8.50 |
| 7.95 | 8.64 | 8.27 |
| 7.31 | 8.58 | 8.30 |
| 7.42 | 8.15 | 8.00 |
| 7.46 | 8.03 | 7.92 |
| 7.69 | 8.32 | 8.26 |
| 8.15 | 8.60 | 8.36 |
| 8.52 | 8.97 | 8.63 |
| 8.48 | 9.09 | 8.86 |
| 8.44 | 8.98 | 8.87 |

| Harmonics (dBc) | | |
|---|---|---|
| F2 | F3 | F4 |
| -25.2 | -23.5 | -33.8 |
| -33.6 | -21.9 | -44.1 |
| -29.1 | -22.8 | -36.7 |
| -27.4 | -23.8 | -32.4 |
| -27.9 | -24.9 | -35.1 |
| -29.0 | -28.0 | -43.8 |
| -28.0 | -36.6 | -50.7 |
| -27.2 | -36.0 | -45.9 |
| -27.5 | -41.3 | -42.4 |
| -28.8 | -36.6 | -38.7 |
| -31.8 | -33.1 | -37.0 |
| -31.6 | -32.4 | -39.2 |
| -27.5 | -33.0 | -42.8 |
| -25.7 | -34.5 | -47.4 |
| -23.6 | -35.9 | -47.7 |
| -23.5 | -36.2 | -46.1 |

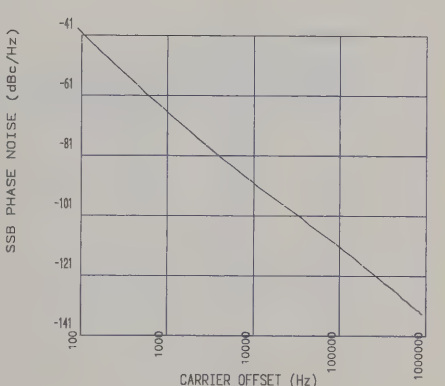
FREQ. VARIATION WITH TEMPERATURE




FREQUENCY PUSHING




PHASE NOISE




**FREQUENCY(MHz)**

| V-TUNE | -55°C | +25°C | +85°C |
|---|---|---|---|
| 1.0 | 626.90 | 616.50 | 609.08 |
| 2.0 | 667.15 | 656.40 | 649.63 |
| 3.0 | 697.26 | 686.95 | 681.65 |
| 4.0 | 725.92 | 717.23 | 711.85 |
| 5.0 | 755.70 | 748.42 | 739.97 |
| 6.0 | 788.73 | 777.42 | 766.42 |
| 7.0 | 816.86 | 805.13 | 793.90 |
| 8.0 | 846.70 | 835.47 | 824.70 |
| 9.0 | 878.96 | 867.33 | 856.78 |
| 10.0 | 910.30 | 898.35 | 888.22 |
| 11.0 | 946.17 | 932.78 | 922.00 |
| 12.0 | 979.23 | 964.68 | 952.73 |
| 13.0 | 1007.05 | 992.13 | 978.85 |
| 14.0 | 1029.60 | 1015.10 | 1001.43 |
| 15.0 | 1048.83 | 1034.03 | 1020.18 |
| 16.0 | 1065.93 | 1050.93 | 1036.63 |

**FREQUENCY PUSHING (MHz)**
(REFERRED TO Vcc=12V)

| 11V | 13V |
|---|---|
| 0.51 | 0.87 |
| -0.07 | 0.12 |
| 0.08 | 0.21 |
| 0.60 | 0.74 |
| -0.38 | -0.08 |
| -0.42 | -0.25 |
| -0.27 | -0.08 |
| 0.38 | -0.03 |
| 0.07 | 0.03 |
| 1.33 | 1.12 |
| 0.92 | 1.48 |
| -0.05 | 0.00 |
| -0.90 | -0.42 |
| -1.08 | -0.69 |
| -1.22 | -0.82 |
| -1.32 | -0.97 |

**PHASE NOISE**

| CARRIER OFFSET (Hz) | SSB PHASE NOISE (dBc/Hz) |
|---|---|
| 100 | -41 |
| 1000 | -68 |
| 10000 | -92 |
| 100000 | -112 |
| 1000000 | -136 |

In Stock... Immediate Delivery

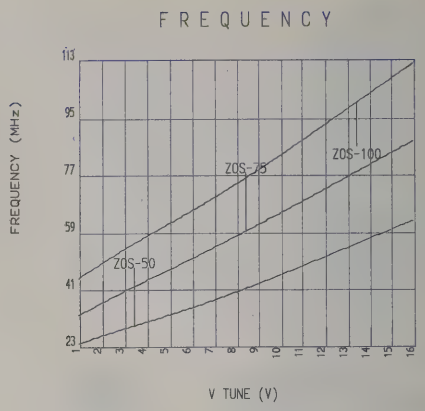
For Custom Versions Of Standard Models Consult Our Applications Dept.

# VOLTAGE CONTROLLED OSCILLATORS

## *Linear, Dual Output*

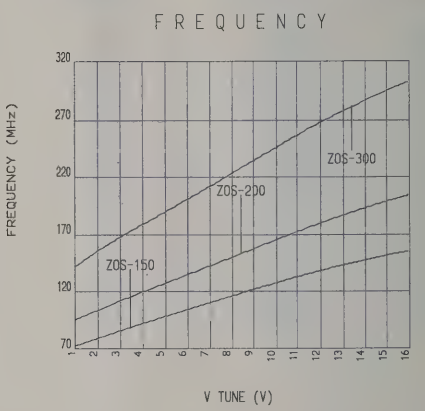
### Frequency (MHz)

| V tune (V) | ZOS-50 | ZOS-75 | ZOS-100 | ZOS-150 | ZOS-200 | ZOS-300 | ZOS-400 | ZOS-535 | ZOS-765 | ZOS-1025 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 23.50 | 32.55 | 44.10 | 71.82 | 94.83 | 140.88 | 188.51 | 285.70 | 477.80 | 625.46 |
| 2 | 25.91 | 36.15 | 48.55 | 78.35 | 102.66 | 154.48 | 206.23 | 310.26 | 518.50 | 663.05 |
| 3 | 28.11 | 39.81 | 53.01 | 84.79 | 110.86 | 166.25 | 221.73 | 330.60 | 552.11 | 691.83 |
| 4 | 30.20 | 43.16 | 57.00 | 91.14 | 118.55 | 177.26 | 236.00 | 348.36 | 580.51 | 720.73 |
| 5 | 32.31 | 46.48 | 60.88 | 97.10 | 125.90 | 187.63 | 250.63 | 365.80 | 604.58 | 751.21 |
| 6 | 34.53 | 49.83 | 64.85 | 103.00 | 133.28 | 198.85 | 265.86 | 383.18 | 625.96 | 781.83 |
| 7 | 36.90 | 53.38 | 68.97 | 108.90 | 140.76 | 209.53 | 280.43 | 400.80 | 644.60 | 810.83 |
| 8 | 39.43 | 56.95 | 73.26 | 114.78 | 148.30 | 221.15 | 296.53 | 416.96 | 659.96 | 843.43 |
| 9 | 42.10 | 60.58 | 77.73 | 120.62 | 156.00 | 232.70 | 312.45 | 438.38 | 692.20 | 877.01 |
| 10 | 44.86 | 64.25 | 82.38 | 126.32 | 163.56 | 243.51 | 326.91 | 461.06 | 721.35 | 907.96 |
| 11 | 47.66 | 67.95 | 87.12 | 131.80 | 171.06 | 255.20 | 339.70 | 480.18 | 746.93 | 940.21 |
| 12 | 50.53 | 71.75 | 91.98 | 137.00 | 178.31 | 266.06 | 354.71 | 497.68 | 770.05 | 973.75 |
| 13 | 53.40 | 75.58 | 96.88 | 141.86 | 185.01 | 275.51 | 368.11 | 513.36 | 790.50 | 1002.18 |
| 14 | 56.30 | 79.46 | 101.76 | 146.35 | 191.46 | 284.78 | 379.78 | 526.45 | 808.60 | 1025.31 |
| 15 | 59.21 | 83.30 | 106.67 | 150.49 | 197.45 | 293.80 | 389.98 | 535.45 | 824.46 | 1044.81 |
| 16 | 62.08 | 87.01 | 111.52 | 154.22 | 202.80 | 301.78 | 398.81 | 546.08 | 838.33 | 1061.70 |



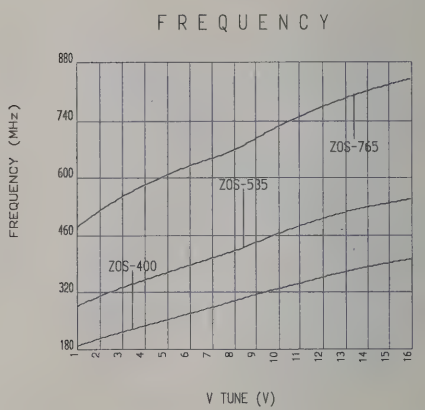

### Pout Main (dBm)

| V tune (V) | ZOS-50 | ZOS-75 | ZOS-100 | ZOS-150 | ZOS-200 | ZOS-300 | ZOS-400 | ZOS-535 | ZOS-765 | ZOS-1025 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.31 | 9.17 | 9.93 | 9.69 | 10.05 | 8.85 | 9.99 | 8.81 | 8.07 | 9.24 |
| 2 | 10.12 | 9.99 | 10.09 | 10.17 | 10.40 | 9.42 | 10.24 | 9.25 | 8.50 | 9.17 |
| 3 | 10.17 | 9.86 | 9.98 | 9.99 | 10.39 | 9.53 | 10.37 | 9.47 | 8.67 | 9.22 |
| 4 | 10.11 | 9.70 | 9.89 | 9.88 | 10.36 | 9.60 | 10.44 | 9.59 | 8.93 | 9.01 |
| 5 | 10.00 | 9.52 | 9.78 | 9.79 | 10.28 | 9.71 | 10.44 | 9.71 | 8.74 | 8.68 |
| 6 | 9.82 | 9.33 | 9.69 | 9.70 | 10.18 | 9.68 | 10.33 | 9.70 | 8.75 | 8.64 |
| 7 | 9.60 | 9.12 | 9.57 | 9.60 | 10.09 | 9.65 | 10.15 | 9.60 | 8.72 | 8.65 |
| 8 | 9.33 | 8.87 | 9.42 | 9.49 | 10.00 | 9.61 | 10.01 | 9.48 | 8.53 | 8.37 |
| 9 | 9.02 | 8.60 | 9.28 | 9.36 | 9.87 | 9.65 | 9.95 | 9.20 | 8.46 | 8.26 |
| 10 | 8.66 | 8.32 | 9.11 | 9.23 | 9.75 | 9.59 | 9.95 | 9.17 | 7.97 | 8.12 |
| 11 | 8.27 | 8.01 | 8.93 | 9.10 | 9.66 | 9.46 | 9.95 | 9.15 | 7.84 | 7.85 |
| 12 | 7.87 | 7.71 | 8.71 | 8.96 | 9.56 | 9.32 | 9.72 | 8.96 | 7.68 | 7.75 |
| 13 | 7.46 | 7.40 | 8.53 | 8.82 | 9.46 | 9.24 | 9.56 | 8.83 | 7.34 | 7.72 |
| 14 | 7.05 | 7.09 | 8.33 | 8.70 | 9.37 | 9.14 | 9.41 | 8.56 | 7.03 | 7.68 |
| 15 | 6.61 | 6.81 | 8.13 | 8.55 | 9.30 | 9.03 | 9.28 | 8.25 | 6.72 | 7.65 |
| 16 | 6.20 | 6.53 | 7.94 | 8.43 | 9.25 | 8.96 | 9.15 | 8.00 | 6.47 | 7.52 |



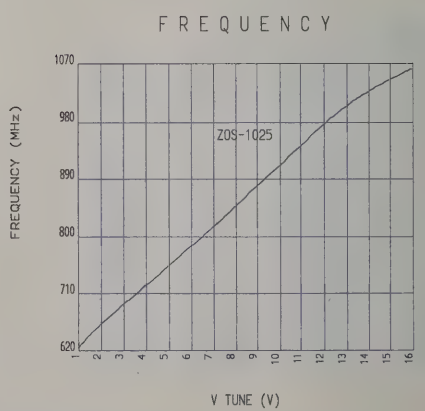

### Pout Aux (dBm)

| V tune (V) | ZOS-50 | ZOS-75 | ZOS-100 | ZOS-150 | ZOS-200 | ZOS-300 | ZOS-400 | ZOS-535 | ZOS-765 | ZOS-1025 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -12.65 | -12.92 | -12.25 | -12.22 | -12.03 | -14.73 | -12.23 | -13.80 | -14.68 | -12.87 |
| 2 | -11.76 | -11.94 | -11.43 | -11.45 | -11.27 | -13.51 | -12.05 | -13.41 | -14.38 | -12.31 |
| 3 | -11.40 | -11.58 | -11.42 | -11.35 | -11.15 | -13.13 | -11.89 | -13.25 | -14.26 | -12.31 |
| 4 | -11.41 | -11.70 | -11.49 | -11.46 | -11.16 | -13.10 | -11.80 | -13.18 | -14.10 | -12.46 |
| 5 | -11.45 | -11.80 | -11.59 | -11.54 | -11.22 | -13.01 | -11.82 | -13.10 | -14.11 | -12.60 |
| 6 | -11.57 | -12.03 | -11.63 | -11.61 | -11.28 | -12.89 | -12.00 | -13.09 | -14.26 | -12.68 |
| 7 | -11.75 | -12.16 | -11.72 | -11.69 | -11.35 | -12.97 | -12.22 | -13.24 | -14.34 | -12.77 |
| 8 | -11.96 | -12.28 | -11.84 | -11.76 | -11.48 | -13.02 | -12.39 | -13.40 | -14.60 | -12.90 |
| 9 | -12.18 | -12.47 | -11.89 | -11.83 | -11.58 | -13.06 | -12.50 | -13.73 | -14.65 | -12.95 |
| 10 | -12.38 | -12.70 | -12.02 | -11.97 | -11.64 | -13.12 | -12.51 | -13.81 | -15.07 | -12.98 |
| 11 | -12.67 | -12.91 | -12.13 | -12.10 | -11.78 | -13.21 | -12.52 | -13.85 | -15.53 | -13.03 |
| 12 | -12.99 | -13.14 | -12.25 | -12.18 | -11.85 | -13.28 | -12.86 | -14.05 | -15.49 | -13.16 |
| 13 | -13.28 | -13.36 | -12.31 | -12.26 | -11.91 | -13.39 | -13.02 | -14.23 | -15.68 | -13.13 |
| 14 | -13.50 | -13.64 | -12.46 | -12.37 | -12.03 | -13.43 | -13.20 | -14.50 | -15.98 | -13.04 |
| 15 | -13.86 | -13.78 | -12.67 | -12.49 | -12.06 | -13.67 | -13.36 | -14.81 | -16.62 | -13.07 |
| 16 | -14.13 | -14.01 | -12.87 | -12.58 | -12.12 | -13.73 | -13.50 | -15.12 | -16.96 | -13.05 |




### 2nd Harmonics (dBc)

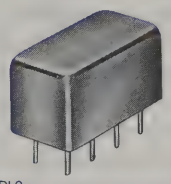
| V tune (V) | ZOS-50 | ZOS-75 | ZOS-100 | ZOS-150 | ZOS-200 | ZOS-300 | ZOS-400 | ZOS-535 | ZOS-765 | ZOS-1025 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -19.65 | -27.16 | -28.74 | -27.29 | -28.13 | -29.83 | -23.71 | -30.14 | -30.20 | -23.08 |
| 2 | -19.30 | -23.33 | -27.06 | -23.77 | -23.61 | -51.35 | -21.72 | -29.70 | 29.40 | -23.55 |
| 3 | -19.84 | -24.03 | -27.26 | -24.75 | -23.06 | -37.59 | -21.04 | -27.37 | 28.91 | -25.07 |
| 4 | -20.45 | -24.85 | -27.49 | -25.29 | -22.86 | -33.84 | -20.74 | -26.61 | -27.49 | -25.56 |
| 5 | -21.50 | -25.83 | -27.88 | -25.52 | -23.12 | -30.94 | -21.03 | -25.72 | -27.76 | -25.20 |
| 6 | -22.49 | -26.46 | -28.29 | -25.90 | -23.84 | -30.38 | -21.38 | -25.83 | -27.27 | -27.57 |
| 7 | -23.94 | -27.23 | -28.67 | -25.95 | -24.41 | -29.80 | -22.02 | -25.85 | -26.41 | -29.74 |
| 8 | -25.50 | -27.80 | -29.02 | -26.15 | -24.79 | -29.44 | -22.99 | -25.38 | -26.23 | -28.96 |
| 9 | -27.67 | -28.37 | -29.21 | -26.36 | -25.47 | -28.47 | -24.06 | -26.07 | -27.14 | -28.21 |
| 10 | -30.30 | -28.75 | -29.87 | -26.74 | -26.32 | -28.69 | -24.70 | -27.02 | -28.02 | -28.09 |
| 11 | -33.74 | -28.77 | -30.86 | -27.10 | -26.89 | -29.37 | -25.17 | -27.78 | -29.37 | -28.07 |
| 12 | -38.17 | -28.65 | -31.62 | -27.44 | -27.29 | -30.03 | -25.88 | -28.24 | -30.25 | -28.22 |
| 13 | -44.90 | -28.33 | -32.10 | -27.79 | -27.52 | -30.44 | -26.89 | -29.07 | -30.58 | -28.76 |
| 14 | -47.31 | -27.85 | -32.38 | -28.49 | -27.75 | -30.49 | -28.22 | -30.11 | -31.43 | -27.89 |
| 15 | -41.55 | -27.90 | -32.81 | -28.99 | -28.17 | -31.53 | -30.60 | -30.67 | -32.50 | -28.03 |
| 16 | -38.14 | -28.12 | -33.28 | -29.87 | -28.24 | -32.27 | -31.56 | -31.58 | -33.24 | -28.20 |






Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 " 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

## 6 to 20 dBm 10 kHz to 900 MHz Minimum Δ Phase



PLS

| MODEL NO. | FREQUENCY MHz $F_L$ $F_U$ | INPUT dBm Min. | INPUT dBm Max. | *OUTPUT dBm Typ. | CONTROL CURRENT (mA) Typ. | LIMITING Input range, Δ Output/Δ 1dB Input dBm | LIMITING amp, dB | LIMITING phase, deg. | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | connection | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLS-1 | 0.1 - 150 | 6 | 20 | -- 4.0 | 3 | 6 to 10<br>10 to 16<br>16 to 20 | 0.10<br>0.15<br>0.15 | 0.8<br>0.8<br>0.7 | 10-5 | A01 | dm | 22.95 |
| PLS-2 | 100 - 900 | 3 | 15 | -- 5.0 | 5 | 3 to 8<br>8 to 12<br>12 to 15 | 0.20<br>0.40<br>0.40 | 2.0<br>2.0<br>2.0 | 10-5 | A01 | dn | 22.95 |
| PLS-6 | 0.01 - 1 | 6 | 20 | -- 0.5 | 5 | 6 to 10<br>10 to 16<br>16 to 20 | 0.20<br>0.10<br>0.20 | 1.0<br>1.0<br>1.5 | 10-6 | A01 | dp | 35.95 |

NOTES:

* Typical output level at typical control current, level may be changed by varying current.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in General Information (section 0).

B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current rating:
   1a. RF input power, 100mW
   1b. Control current, 10mA

### pin connections

see case style outline drawings

| PORT | dm | dn | dp |
|---|---|---|---|
| INPUT | 1 | 1 | 1 |
| OUTPUT | 8 | 8 | 8 |
| CONTROL | 3,4 ^ | 3,4 ^ | 3,4 |
| GND EXT. | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 |
| CASE GND | 2 | 2,5,6,7 | — |

^ pins must be connected together externally

**NSN GUIDE**

| MCL NO. | NSN |
|---|---|
| PLS-1 | 5895-01-105-7820 |
| PLS-2 | 5895-01-390-0151 |
| PLS-6 | 5820-01-249-8320 |

In Stock... Immediate Delivery

For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

# RF Transformers

RF transformers are widely used in low-power electronic circuits for impedance matching to achieve maximum power transfer, for voltage step-up or step-down, and for isolating dc from two circuits while maintaining ac continuity. They are also used for common mode rejection and as baluns.

Essentially, an RF transformer consists of two windings linked by a mutual magnetic field. When one winding, the primary has a ac voltage applied to it, a varying flux is developed; the amplitude of the flux is dependent on the applied voltage and number of turns in the winding. Mutual flux linked to the secondary winding induces a voltage whose amplitude depends on the number of turns in the secondary winding. By designing the number of turns in the primary and secondary windings, any desired step-up or step-down voltage ratio can be realized. Mutual coupling is accomplished simply with an air core but considerably more effective flux linkage is obtained with the use of a core of iron or ferromagnetic material with higher permeability than air.

The relationship between voltage, current, and impedance between the primary and secondary windings of the transformer may be calculated using the following relationships. With reference to Figure 1,

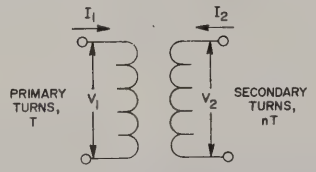



FIGURE 1

$$V_2 = nV_1$$

$$I_2 = I_1/n$$

$$Z_2 = \frac{V_2}{I_2} = \frac{nV_1}{I_1/n} = n^2\frac{V_1}{I_1} = n^2Z_1$$

thus $Z_2 = n^2Z_1$.

As an example, if Z equals 50 ohms and the turns ratio equals 2, the secondary impedance equals 200 ohms. In this case, the secondary voltage is twice the primary voltage and the secondary current is one-half the primary current.

The basic phase relationship between the RF signals at the transformer input and output ports may be in-phase, 0 degrees, or out-of-phase, 180 degrees. Conventionally, the ports that are in-phase 1 and 3 are marked by dot notation as shown in Figure 2. Ports 1, 4 and 2, 3 are out-of-phase, 180 degrees.

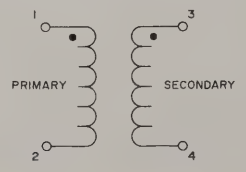



FIGURE 2

Mini-Circuits' transformers are physically assembled by winding a pair of twisted wires around a ferrite toroidal core. The ends of the primary and secondary wires which leave the same side of the toroid are in the in-phase ports. See Figure 3.

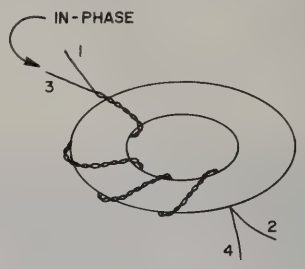



FIGURE 3

For transformers that have a secondary winding with a center-tap, the schematic representation and dot locations are shown in Figure 4.

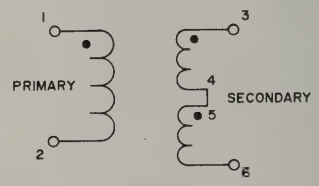
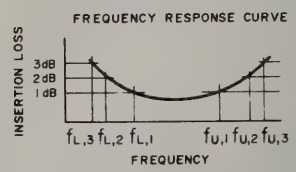



FIGURE 4

In this case ports 1 and 3 are in-phase, 0 degrees, and ports 1 and 6 are out-of-phase, 180 degrees. These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response. For convenience, all Mini-Circuits transformers are specified as a step-up.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Figure 5 and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.




Mini-Circuits offers various transformer package styles for assembly on a printed circuit board. These include:

(1) plastic-case T series, style X65, plug-in leads
(2) plastic-case T series, style W38, flat-pack leads
(3) plastic-case T series, style KK81, surface-mount gull wing leads

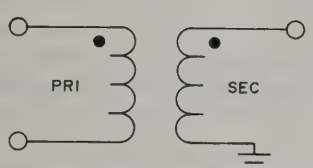

Mini-Circuits™ P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

(4) metal-case TMO series, plug-in leads
(5) open construction TC series, surface-mount leadless

For these various types, the electrical configurations that are available are:

(A) DC isolated primary and secondary, center-tap secondary
(B) DC isolated primary and secondary, center-tap primary and secondary
(C) DC isolated primary and secondary
(D) unbalanced primary and secondary
(E) DC isolated primary and secondary, balanced primary and unbalanced secondary
(F) DC isolated, three open windings

Coaxial connector models are available from 5 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT1.5-1, with unbalanced input and output is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.



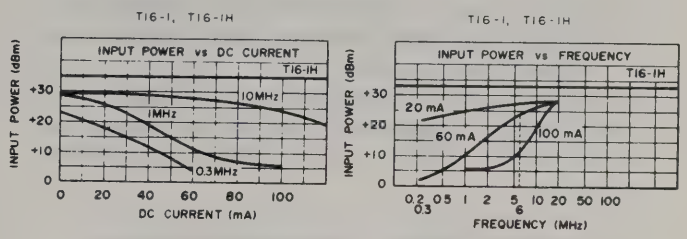

In some applications there is a need to pass a relatively high DC current through the primary winding. In this case, the transformer core may saturate resulting in reduced transformer bandwidth and power handling capability. Mini-Circuits TH series of transformers are designed to handle up to 100 mA in the primary winding without appreciable saturation and change in RF characteristics.

Transformer core saturation is influenced by (1) DC current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs. See Figures 7 and 8 in which conventional transformer saturation is compared to the TH series.

Mini-Circuits has developed many special transformer impedance ratios and configurations where high DC current is passed through one winding of the transformer. Many of these designs have been for open package surface-mount requirements. Consult our Applications Department for your particular needs.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)




# modern definition of terms

## amplitude balance

is a measure of the absolute difference in signal amplitude between each output of a center-tapped transformer relative to the center-tap.

## phase balance

is a measure of the difference in signal phase between each output of a center-tapped transformer relative to the center-tap.

## insertion loss

is the amount of power lost through the transformer under matched conditions.

## balun

is a transformer that has a balanced input, where both ports are isolated from ground, to an unbalanced output where one side is connected to ground.

## autotransformer

is a transformer where the secondary winding also comprises a portion of the primary winding.

## 1 dB bandwidth

is the frequency range over which insertion loss is less than 1dB referenced to the midband insertion loss.

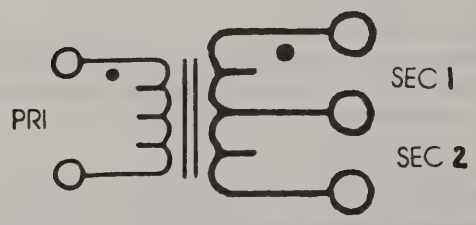
# most often asked questions about transformers

**Q: *Explain the difference between DC-isolated and non-isolated transformers.***
**A:** A DC-isolated transformer is one that does not allow a DC current to pass between the primary and secondary windings.

**Q: *Mini-Circuits transformers are tested with 50-ohm systems. How do they perform at other impedance?***
**A:** Mini-Circuits' transformers can be used over a wide range of impedance ranges with an impedance as low as 12.5 ohms with a only small change in the bandwidth.

**Q: *Are Mini-Circuits' transformers step-up or step-down?***
**A:** All Mini-Circuits transformers are specified as step-up transformers. However, they are tested both ways and may be used as a step-up or a step-down.

**Q: *Can I just use one side of a center-tapped transformer?***
**A:** Yes. You may use one side of the transformer but you should remember you will obtain only one-fourth of the impedance ratio.

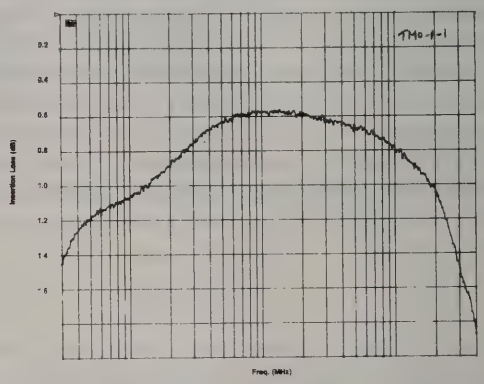



**Q: *Can Mini-Circuits supply MIL-tested transformers?***
**A:** Yes, Mini-Circuits' hermetically-sealed TMO transformers meet military needs. Please submit your environmental requirements to Mini-Circuits for review.

**Q: *What are the effects of temperature extremes on Mini-Circuits transformers?***
**A:** The permeability of the core is influenced by temperature. As the temperature decreases, there is a change in the permeability causing an increase in the insertion loss at low frequency.

As temperature increases, the permeability increases thereby slightly decreasing insertion loss at low frequency. This is true, however, as long as the temperature does not increase above the Curie temperature of the core. Mini-Circuits' designs use cores that have a Curie temperature much higher than the highest specified operating temperature.

**Q: *Explain the reasons for low-end and high-end losses of a transformer.***
**A:** The general curve for a transformer vs. insertion loss is shown below.




The low-end loss is heavily influenced by the primary inductance while the high-end loss is attributed to the interwinding capacitance and series inductance.

**Q: *How do I measure the insertion loss of a transformer?***
**A:** The insertion loss is measured on two transformers connected back-to-back (impedance matched) and dividing the resulting insertion loss by two.

**Q: *Can I build a power splitter with Mini-Circuits' transformers?***
**A:** You can use the Mini-Circuits' T2-1T, to create a 50- ohm, 180 degree power splitter.

The isolation between output ports and the output return loss of each port will not be as good as a Mini-Circuits' standard power splitter.

**Q: *What are the breakdown voltage ratings of Mini- Circuits' transformers?***
**A:** Mini-Circuits does not typically specify a breakdown voltage. However, many of our transformers are able to handle up to 1000 VRMS. Please contact the factory about the transformer of your choice.


Mini-Circuits™
P O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

Mini-Circuits

SPECIFICATIONS CHECKLIST

# Transformers

If your particular requirements are not met with a Mini-Circuits catalog item, please complete the check list below and mail, phone, or fax it to Mini-Circuits, Applications Engineering.

*Please indicate:* Critical Parameter ✔✔
Important Parameter ✔

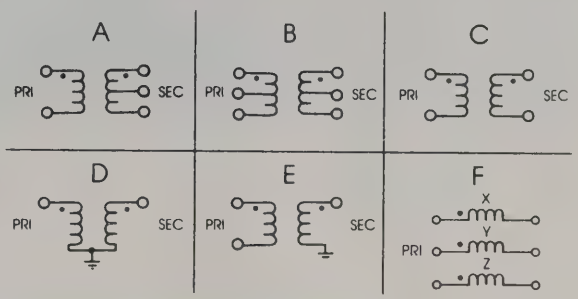
## Application:

☐ Industrial/Commercial
☐ Military ☐ Space

## Electrical:

Frequency range _____ MHz
Schematic ☐ A ☐ B ☐ C ☐ D ☐ E ☐ F
Impedence
Primary ____ ohms, Secondary ____ ohms
VSWR or return loss (dB)
Primary _____ Secondary _____
Bandwidth
1 dB _____ MHz to _____ MHz
2 dB _____ MHz to _____ MHz
3 dB _____ MHz to _____ MHz
Amplitude unbalance _____ dB
Phase unbalance _____ deg.
DC current through windings
Primary _____ mA, Secondary _____ mA
Through center tap?
Primary ☐ Yes ☐ No Secondary ☐ Yes ☐ No
Insulation Resistance
Primary to secondary _____ ohms
Dielectric withstanding voltage _____ V.
☐ DC ☐ AC
Operating temperature _____ °C

## Schematic




## Diagram of application:

## Mechanical:

Standard case style _____ *(for outline drawings see Table of Contents. Non-standard case, complete list below).*

## Special Requirements: _____

_____

PC Board Mounting

☐ Plug-in ☐ Flat pack
☐ Surface-mount

Coaxial Connector
*(Specify connector for input & output separately)*

☐ BNC ☐ TNC ☐ Isolated female BNC
☐ SMA ☐ Type N ☐ Other

Name _____ Title _____

Company _____ Dept. _____

Company address _____

Phone _____ Fax _____

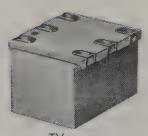
Mini-Circuits™
Distribution Centers NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945
P O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
EUROPE 44-252-835094 Fax 44-252-837010

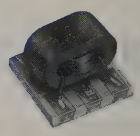
In Stock...Immediate Delivery

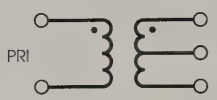
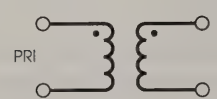
# RF TRANSFORMERS WIDEBAND 12.5 to 1800 Ω

## 4 kHz to 1500 MHz

T-KK81
TT-KK81


TX


TC

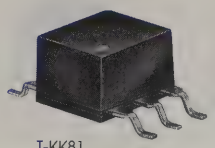
| | | MODEL NO. | Ω RATIO | FREQUENCY MHz | INSERTION LOSS ✲ 3 dB MHz | 2 dB MHz | 1 dB MHz | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A* |  PRI SEC | T1-1T-KK81 | 1 | .05-200 | .05-200 | .08-150 | .2-80 | 14-8 | KK81 | ev | 4.45 |
| | | T1-6T-KK81 | 1 | .015-300 | .015-300 | .021-150 | .03-50 | 14-8 | KK81 | ev | 6.95 |
| | | T2-1T-KK81 | 2 | .07-200 | .07-200 | .1-100 | .5-50 | 14-8 | KK81 | ev | 4.95 |
| | | T2.5-6T-KK81 | 2.5 | .01-100 | .01-100 | .02-50 | .50-20 | 14-8 | KK81 | ev | 4.95 |
| | | T3-1T-KK81 | 3 | .05-250 | .05-200 | .1-200 | .5-70 | 14-8 | KK81 | ev | 4.95 |
| | | T4-1-KK81 | 4 | .2-350 | .2-350 | .35-300 | 2-100 | 14-9 | KK81 | ev | 3.25 |
| | | T4-6T-KK81 | 4 | .02-250 | .02-250 | .05-150 | 0.1-100 | 14-9 | KK81 | ev | 4.45 |
| | | T5-1T-KK81 | 5 | .3-300 | .3-300 | .6-200 | 5-100 | 14-9 | KK81 | ev | 4.95 |
| | | T8-1T-KK81 | 8 | .3-140 | .3-140 | .7-90 | 1-60 | 14-9 | KK81 | ev | 7.95 |
| | | T13-1T-KK81 | 13 | .3-120 | .3-120 | .7-80 | 5-20 | 14-9 | KK81 | ev | 4.95 |
| | | T16-6T-KK81 | 16 | .03-75 | .03-75 | .06-30 | .1-20 | 14-10 | KK81 | ev | 5.65 |
| | | T4-1H-KK81 | 4 | 10-350 | 10-350 | 15-300 | 25-200 | 14-10 | KK81 | ev | 5.95 |
| | | TX16-R3T | 16 | 40-300 | 40-300 | 60-220 | 70-150 | — | TT100 | ev | 4.95 |
| | | TC4-1W | 4 | 3-800 | 3-800 | 5-400 | 10-100 | — | AT224 | ha | 4.95 |
| | | TC4-14 | 4 | 200-1400 | 200-1400 | 300-1300 | 800-1100 | — | AT224 | gs | 5.45 |
| | | TC8-1 | 8 | 2-500 | 2-500 | 5-400 | 10-100 | — | AT224 | gs | 5.45 |
| B* | PRI SEC | ❖ TT1-6-KK81 | 1 | .004-300 | .004-300 | .02-200 | .1-50 | 14-12 | KK81 | ex | 6.95 |
| | | TT1.5-1-KK81 | 1.5 | .075-500 | .075-500 | .2-100 | 1-50 | 14-12 | KK81 | ex | 5.95 |
| | | TT2.5-6-KK81 | 2.5 | .01-50 | .01-50 | .025-25 | .05-10 | 14-12 | KK81 | ex | 6.45 |
| | | TT4-1-KK81 | 3 | .05-200 | .05-200 | .2-50 | 1-30 | 14-12 | KK81 | ex | 5.95 |
| | | TT4-1A-KK81 | 4 | 0.1-300 | 0.1-300 | 0.2-250 | 0.3-180 | 14-12 | KK81 | ex | 6.95 |
| | | TT16-1-KK81 | 16 | 0.1-45 | 0.1-45 | 0.14-35 | 1-20 | 14-13 | KK81 | ex | 9.95 |
| | | TT25-1-KK81 | 25 | .02-30 | .02-30 | .05-20 | .1-10 | 14-13 | KK81 | ex | 9.95 |
| C |  PRI SEC | T1-1-KK81 | 1 | .15-400 | .15-400 | .35-200 | 2-50 | 14-14 | KK81 | ez | 3.25 |
| | | T1.18-3-KK81 | 1.18 | 0.01-250 | 0.01-250 | 0.02-200 | 0.03-50 | 14-14 | KK81 | ez | 5.65 |
| | | T1-6-KK81 | 1 | .01-150 | .01-150 | .02-100 | .05-50 | 14-14 | KK81 | ez | 5.65 |
| | | T1.5-1-KK81 | 1.5 | .1-300 | .1-300 | .2-150 | .5-80 | 14-14 | KK81 | ez | 4.45 |
| | | T1.5-6-KK81 | 1.5 | .02-100 | .02-100 | .05-50 | 0.1-25 | 14-14 | KK81 | ez | 5.65 |
| | | T2-1-2W-KK81 | 2 | 5-120 | — | — | 5-120 | - | KK81 | ez | 5.95 |
| | | T2.5-6-KK81 | 2.5 | .01-100 | .01-100 | .02-50 | .05-20 | 14-15 | KK81 | ez | 4.45 |
| | | T4-1-2W-KK81 | 4 | 10-250 | — | — | 10-250 | - | KK81 | ez | 5.95 |
| | | T4-6-KK81 | 4 | .02-200 | .02-200 | .05-150 | .1-100 | 14-15 | KK81 | ez | 4.45 |
| | | T9-1-KK81 | 9 | .15-200 | .15-200 | .3-150 | 2-40 | 14-15 | KK81 | ez | 3.95 |
| | | T16-1-KK81 | 16 | .3-120 | .3-120 | .7-80 | 5-20 | 14-15 | KK81 | ez | 4.45 |
| | | T36-1-KK81 | 36 | .03-20 | .03-20 | .05-10 | .1-5 | 14-15 | KK81 | ez | 6.95 |
| | | T1-1H-KK81 | 1 | 8-300 | 8-300 | 10-200 | 25-100 | 14-16 | KK81 | ez | 5.95 |
| | | T9-1H-KK81 | 9 | 2-90 | 2-90 | 3-75 | 6-50 | 14-16 | KK81 | ez | 6.45 |
| | | T16-1H-KK81 | 16 | 7-85 | 7-85 | 10-65 | 15-40 | 14-16 | KK81 | ez | 6.45 |
| | | TC1-1 | 1 | 1.5-500 | 1.5-500 | 2.5-400 | 5-350 | — | AT224 | hd | 4.95 |
| | | ★ TC1-15 | 1 | 800-1500 | — | 350-1500 | 800-1500 | — | AT224 | gw | 4.95 |
| | | TX1-1 | 1 | 0.3-400 | 0.3-400 | 0.6-200 | 2-50 | 14-14 | TT100 | ez | 3.50 |
| | | TX1-R5 | 1 | 0.8-500 | 0.8-500 | 1.2-350 | 3.2-180 | - | TT100 | ez | 3.75 |
| | | TX1.5-1 | 1.5 | 0.25-300 | 0.25-300 | 0.3-150 | 0.5-80 | 14-14 | TT100 | ez | 4.70 |
| | | TX16-1 | 16 | 0.4-120 | 0.4-120 | 0.7-80 | 5-20 | 14-15 | TT100 | ez | 4.70 |

**NSN GUIDE**

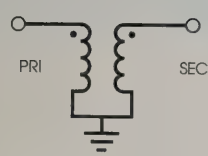
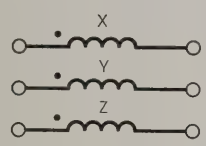
| MCL NO. | NSN |
|---|---|
| T1-1-KK81 | 5950-01-347-0310 |
| T2-1T-KK81 | 5950-01-347-0311 |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010



T-KK81
TT-KK81

| | | MODEL NO. | Ω RATIO | FREQUENCY MHz | INSERTION LOSS* 3 dB MHz | 2 dB MHz | 1 dB MHz | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D |   | T2-1-KK81 | 2 | .050-600 | .050-600 | .1-400 | .5-200 | 14-19 | KK81 | fd | 3.95 |
| | | T3-1-KK81 | 3 | .5-800 | .5-800 | 2-400 | — | 14-19 | KK81 | fd | 4.45 |
| | | T4-2-KK81 | 4 | .2-600 | .2-600 | .5-500 | 2-250 | 14-19 | KK81 | fd | 3.95 |
| | | T8-1-KK81 | 8 | .15-250 | .15-250 | .25-200 | 2-100 | 14-19 | KK81 | fd | 3.95 |
| | | T14-1-KK81 | 14 | .2-150 | .2-150 | .5-100 | 2-50 | 14-19 | KK81 | fd | 4.95 |
| F |   | T-622-KK81 | 1:1:1 | 0.1-200 | 0.1-200 | 0.5-100 | 5-80 | 14-22 | KK81 | ff | 3.25 |
| | | T-626-KK81 | 1:1:1 | 0.01-10 | 0.01-10 | 0.02-5 | .04-2 | 14-22 | KK81 | ff | 3.95 |
| | | T2-613-1-KK81 | 1:1:2 | 0.07-200 | 0.07-200 | 0.1-100 | 0.5-50 | 14-22 | KK81 | fg | 1.95 |

NOTES:

* FOR A AND B CONFIGURATIONS:
Typical Amplitude Unbalance: 0.1 dB over 1 dB frequency range; 0.5 dB over entire frequency range.
Typical Phase Unbalance: 1.0° over 1 dB frequency range; 5.0° over entire frequency range.

✲ Insertion loss referenced to mid-band loss.

✣ Insertion loss is specified with input at pin 4 and output at pin1 with pins 6 & 3 grounded and pins 2 & 5 open.

★ Not DC isolated, insertion loss is measured with input at pin 1, output at pin 6, and pin 3, 4 are grounded.

A. Environmental specifications and re-flow soldering information available in General Information Section.

B. Units are non-hermetic unless otherwise noted. For details on case dimensions & finishes see "Case Styles & Outline Drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute power, voltage and current ratings:
   1a. RF input power: For T2-1-2W and T4-1-2W, 2 Watt;
   All other models 0.25 Watt
   1b. DC current, 30mA

2. For TC, T,TT, TH and TX series, operating temperature range is -20°C to +85°C.

## pin connections

see case style outline drawings

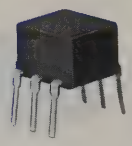
| PORT | ev | ex | ez | fd | ff | fg | gs | gw | ha | hd |
|---|---|---|---|---|---|---|---|---|---|---|
| PRIMARY DOT | 4 | 4 | 4 | 6 | X1 Y2 Z3 | X1 Y5 Z3 | 6 | 1 | 6 | 6 |
| PRIMARY | 6 | 6 | 6 | 3 | X6 Y5 Z4 | X2 Y6 Z4 | 4 | 6 | 4 | 4 |
| PRIMARY CT | — | 5 | — | — | — | — | — | — | — | |
| SECONDARY DOT | 3 | 3 | 3 | 1 | — | — | 3 | 3 | 1 | 1 |
| SECONDARY | 1 | 1 | 1 | 3 | — | — | 1 | 4 | 3 | 3 |
| SECONDARY CT | 2 | 2 | — | — | — | — | 2 | — | 2 | — |
| GND EXT. | — | — | — | 3 | — | — | — | — | | — |
| CASE GND | — | — | — | — | — | — | — | — | — | — |
| NOT USED | 5 | — | 2,5 | 2,4,5 | — | — | — | — | — | 2 |

# RF TRANSFORMERS WIDEBAND

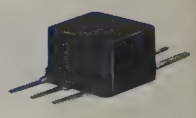
12.5 to 1800 Ω

## 4 kHz to 800 MHz

Style X65



Standard W38



T, TH, TT

| | | MODEL NO. | Ω RATIO | FREQUENCY MHz | INSERTION LOSS ✲ 3 dB MHz | 2 dB MHz | 1 dB MHz | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A* | | T1-1T | 1 | .05-200 | .05-200 | .08-150 | .2-80 | 14-8 | ▽ | ev | 4.45 |
| | | T1-6T | 1 | .015-300 | .015-300 | .021-150 | .03-50 | 14-8 | ▽ | ev | 6.95 |
| | | T2-1T | 2 | .07-200 | .07-200 | .1-100 | .5-50 | 14-8 | ▽ | ev | 4.95 |
| | | T2.5-6T | 2.5 | .01-100 | .01-100 | .02-50 | .50-20 | 14-8 | ▽ | ev | 4.95 |
| | | T3-1T | 3 | .05-250 | .05-200 | .1-200 | .5-70 | 14-8 | ▽ | ev | 4.95 |
| | | T4-1 | 4 | .2-350 | .2-350 | .35-300 | 2-100 | 14-9 | ▽ | ev | 3.25 |
| | | T4-6T | 4 | .02-250 | .02-250 | .05-150 | 0.1-100 | 14-9 | ▽ | ev | 4.45 |
| | | T5-1T | 5 | .3-300 | .3-300 | .6-200 | 5-100 | 14-9 | ▽ | ev | 4.95 |
| | | T8-1T | 8 | .3-140 | .3-140 | .7-90 | 1-60 | 14-9 | ▽ | ev | 7.95 |
| | | T13-1T | 13 | .3-120 | .3-120 | .7-80 | 5-20 | 14-9 | ▽ | ev | 4.95 |
| | | T16-6T | 16 | .03-75 | .03-75 | .06-30 | .1-20 | 14-10 | ▽ | ev | 5.65 |
| | | T4-1H | 4 | 10-350 | 10-350 | 15-300 | 25-200 | 14-10 | ▽ | ev | 5.95 |
| | | TMO1-1T | 1 | .05-200 | .05-200 | .08-150 | .2-80 | 14-10 | A11 | ew | 7.95 |
| | | TMO2-1T | 2 | .07-200 | .07-200 | .1-100 | .5-50 | 14-10 | A11 | ew | 8.45 |
| | | TMO2.5-6T | 2.5 | .01-100 | .01-100 | .02-50 | .05-20 | 14-10 | A03 | ew | 8.45 |
| | | TMO3-1T | 3 | .05-250 | .05-250 | .1-200 | .5-70 | 14-11 | A03 | ew | 7.95 |
| | | TMO4-1 | 4 | .2-350 | .2-350 | .35-300 | 2-100 | 14-11 | A11 | ew | 6.25 |
| | | TMO5-1T | 5 | .3-300 | .3-300 | .6-200 | 5-100 | 14-11 | A11 | ew | 8.45 |
| | | TMO13-1T | 13 | .3-120 | .3-120 | .7-80 | 5-20 | 14-11 | A11 | ew | 8.45 |
| B* | | ✣ TT1-6 | 1 | .004-300 | .004-300 | .02-200 | .1-50 | 14-12 | ▽ | ex | 6.95 |
| | | TT1.5-1 | 1.5 | .075-500 | .075-500 | .2-100 | 1-50 | 14-12 | ▽ | ex | 5.95 |
| | | TT2.5-6 | 2.5 | .01-50 | .01-50 | .025-25 | .05-10 | 14-12 | ▽ | ex | 6.45 |
| | | TT4-1 | 3 | .05-200 | .05-200 | .2-50 | 1-30 | 14-12 | ▽ | ex | 5.95 |
| | | TT4-1A | 4 | 0.1-300 | 0.1-300 | 0.2-250 | 0.3-180 | 14-12 | ▽ | ex | 6.95 |
| | | TT16-1 | 16 | 0.1-45 | 0.1-45 | 0.14-35 | 1-20 | 14-13 | ▽ | ex | 9.95 |
| | | TT25-1 | 25 | .02-30 | .02-30 | .05-20 | .1-10 | 14-13 | ▽ | ex | 9.95 |
| | | TTMO25-1 | 25 | .02-30 | .02-30 | .05-20 | .1-10 | 14-13 | A03 | ey | 11.95 |
| | | TTMO1-1 | 1 | .005-100 | .005-100 | .01-75 | .05-40 | 14-13 | A03 | ey | 11.45 |
| | | TTMO4-1A | 4 | 0.1-300 | 0.1-300 | 0.2-250 | 0.3-180 | 14-13 | A03 | ey | 13.95 |

NOTES:

* FOR A AND B CONFIGURATIONS:
Typical Amplitude Unbalance: 0.1 dB over 1 dB frequency range; 0.5 dB over entire frequency range.
Typical Phase Unbalance: 1.0° over 1 dB frequency range; 5.0° over entire frequency range.

▽ Two case styles available: Plug-in case style X65; Radial lead case style W38.

✲ Insertion loss referenced to mid-band loss

✣ Insertion loss is specified with input at pin 4 and output at pin1 with pins 6 & 3 grounded and pins 2 & 5 open.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".

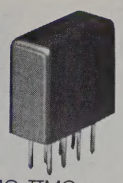
C. Prices and Specifications subject to change without notice.

1. Absolute power, voltage and current ratings:
1a. RF input power: For T2-1-2W and T4-1-2W, 2 Watt;
All other models 0.25 Watt
1b. DC current, 30mA

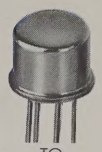
2. For T,TT, and TH series, operating temperature range is -20°C to +85°C.



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

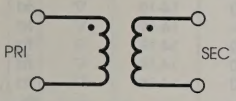


TMO, TTMO



TO

C




| MODEL NO. | Ω RATIO | FREQUENCY MHz | INSERTION LOSS ✲ 3 dB MHz | 2 dB MHz | 1 dB MHz | CAPD DATA (see RF/IF Designer handbook) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|
| T1-1 | 1 | .15-400 | .15-400 | .35-200 | 2-50 | 14-14 | ▽ | ez | 3.25 |
| T1.18-3 | 1.18 | 0.01-250 | 0.01-250 | 0.02-200 | 0.03-50 | 14-14 | ▽ | ez | 5.65 |
| T1-6 | 1 | .01-150 | .01-150 | .02-100 | .05-50 | 14-14 | ▽ | ez | 5.65 |
| T1.5-1 | 1.5 | .1-300 | .1-300 | .2-150 | .5-80 | 14-14 | ▽ | ez | 4.45 |
| T1.5-6 | 1.5 | .02-100 | .02-100 | .05-50 | 0.1-25 | 14-14 | ▽ | ez | 5.65 |
| T2-1-2W | 2 | 5-120 | — | — | 5-120 | - | ▽ | ez | 5.95 |
| T2.5-6 | 2.5 | .01-100 | .01-100 | .02-50 | .05-20 | 14-15 | ▽ | ez | 4.45 |
| T4-1-2W | 4 | 10-250 | — | — | 10-250 | - | ▽ | ez | 5.95 |
| T4-6 | 4 | .02-200 | .02-200 | .05-150 | .1-100 | 14-15 | ▽ | ez | 4.45 |
| T9-1 | 9 | .15-200 | .15-200 | .3-150 | 2-40 | 14-15 | ▽ | ez | 3.95 |
| T16-1 | 16 | .3-120 | .3-120 | .7-80 | 5-20 | 14-15 | ▽ | ez | 4.45 |
| T36-1 | 36 | .03-20 | .03-20 | .05-10 | .1-5 | 14-15 | ▽ | ez | 6.95 |
| TO-75 | 1 | 10-500 | — | 10-500 | 40-250 | 14-16 | PP94 | fa | 6.95 |
| T1-1H | 1 | 8-300 | 8-300 | 10-200 | 25-100 | 14-16 | ▽ | ez | 5.95 |
| T9-1H | 9 | 2-90 | 2-90 | 3-75 | 6-50 | 14-16 | ▽ | ez | 6.45 |
| T16-1H | 16 | 7-85 | 7-85 | 10-65 | 15-40 | 14-16 | ▽ | ez | 6.45 |
| TMO1-02 | 1 | 1-800 | 1-800 | 2-500 | — | 14-16 | A11 | fc | 9.45 |
| TMO1-1 | 1 | .15-400 | .15-400 | .35-200 | 2-50 | 14-17 | A11 | fb | 6.25 |
| TMO1.5-1 | 1.5 | .1-300 | .1-300 | .2-150 | .5-80 | 14-17 | A11 | fb | 8.45 |
| TMO2.5-6 | 2.5 | .01-100 | .01-100 | .02-50 | .05-20 | 14-17 | A03 | fb | 7.95 |
| TMO4-6 | 4 | .02-200 | .02-200 | .05-150 | .1-100 | 14-17 | A03 | fb | 7.95 |
| TMO6-1 | 6 | .3-200 | .3-200 | .5-150 | 5-50 | 14-17 | A11 | fb | 7.95 |
| TMO9-1 | 9 | .15-200 | .15-200 | .3-150 | 2-40 | 14-18 | A11 | fb | 7.95 |
| TMO16-1 | 16 | .3-120 | .3-120 | .7-80 | 5-20 | 14-18 | A11 | fb | 7.95 |

## NSN GUIDE

| MCL NO. | NSN | | | | | | |
|---|---|---|---|---|---|---|---|
| FTB1-1-75 | 5950-01-132-8034 | T4-2 | 5950-01-361-1794 | T4-1H-X65 | 5950-01-328-8975 | TMO4-2 | 5950-01-091-3553 |
| FTB1-6 | 5950-01-225-8773 | T9-1 | 5950-01-105-8153 | TT1-6-X65 | 5950-01-272-2298 | TMO4-6 | 5950-01-132-8102 |
| FT1.5-1 | 5950-01-325-4686 | T16-1 | 5950-01-094-7439 | TT4-1A | 5950-01-331-7777 | TMO5-1T | 5950-01-183-0779 |
| T1-1 | 5950-01-128-3745 | T16-1-X65 | 5950-01-272-2297 | TMO1-1 | 5950-01-213-3735 | TMO6-1 | 5950-01-364-7803 |
| T1-1-X65 | 5950-01-327-5916 | T1-1T | 5950-01-153-0668 | TMO1-1T | 5950-01-326-2772 | TMO9-1 | 5950-01-141-0174 |
| T1-1H | 5950-01-409-2785 | T1-1T-X65 | 5950-01-340-7040 | TMO2-1 | 5950-01-183-6414 | TMO-13-1T | 5950-01-168-7512 |
| T2-1 | 5950-01-106-1218 | T1-6T | 5950-01-258-2173 | TMO2.5-6 | 5950-01-215-4038 | TMO16-1 | 5950-01-138-4593 |
| T4-1 | 5950-01-024-7626 | T3-1T | 5950-01-153-0298 | TMO2.5-6T | 5950-01-215-8697 | TTMO25-1 | 5950-01-415-7145 |
| T4-1-X65 | 5950-01-349-3181 | T16-6T | 5950-01-336-0939 | TMO3-1T | 5950-01-168-7512 | | |

## pin connections

see case style outline drawings

| PORT | ev | ew | ex | ey | ez | fa | fb | fc |
|---|---|---|---|---|---|---|---|---|
| PRIMARY DOT | 4 | 1 | 4 | 1 | 4 | 1 | 1 | 1 |
| PRIMARY | 6 | 5 | 6 | 5 | 6 | 2 | 5 | 3 |
| PRIMARY CT | — | — | 5 | 3 | — | — | — | — |
| SECONDARY DOT | 3 | 2 | 3 | 2 | 3 | 4 | 2 | 2 |
| SECONDARY | 1 | 6 | 1 | 6 | 1 | 3 | 6 | 4 |
| SECONDARY CT | 2 | 4 | 2 | 4 | — | — | — | — |
| CASE EXT. | — | — | — | — | — | — | — | — |
| CASE GND | — | 7,8 | — | 7,8 | — | — | 7,8 | 7,8 |
| NOT USED | 5 | 3 | — | — | 2,5 | — | 3,4 | 5,6 |

In Stock... Immediate Delivery

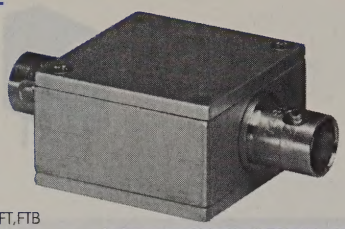
For Custom Versions Of Standard Models Consult Our Applications Dept.

Available Tape & Reel

# RF TRANSFORMERS WIDEBAND

## Plug-In & Coaxial

## 5 kHz to 800 MHz

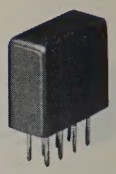


FT,FTB

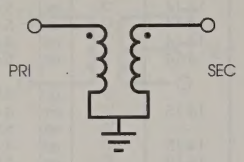
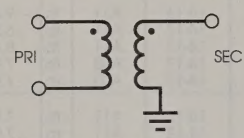
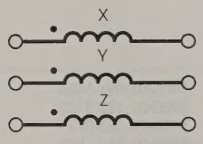
Style X65

Standard W38

T,TH,TT



TMO

| | MODEL NO. | Ω RATIO | FREQUENCY MHz | INSERTION LOSS ✲ 3 dB MHz | 2 dB MHz | 1 dB MHz | CAPD DATA (see RF/IF Designer hand-book) Page | CASE STYLE Note B | CONNECTION | PRICE $ Qty. (1-9) |
|---|---|---|---|---|---|---|---|---|---|---|
| D  PRI SEC | T2-1 | 2 | .050-600 | .050-600 | .1-400 | .5-200 | 14-19 | ▽ | fd | 3.95 |
| | T3-1 | 3 | .5-800 | .5-800 | 2-400 | — | 14-19 | ▽ | fd | 4.45 |
| | T4-2 | 4 | .2-600 | .2-600 | .5-500 | 2-250 | 14-19 | ▽ | fd | 3.95 |
| | T8-1 | 8 | .15-250 | .15-250 | .25-200 | 2-100 | 14-19 | ▽ | fd | 3.95 |
| | T14-1 | 14 | .2-150 | .2-150 | .5-100 | 2-50 | 14-19 | ▽ | fd | 4.95 |
| | TMO2-1 | 2 | .050-600 | .050-600 | .1-400 | .5-200 | 14-20 | A11 | fe | 7.95 |
| | TMO3-1 | 3 | .5-800 | .5-800 | 2-400 | — | 14-20 | A11 | fe | 8.45 |
| | TMO4-2 | 4 | .2-600 | .2-600 | .5-500 | 2-250 | 14-20 | A11 | fe | 7.95 |
| | TMO8-1 | 8 | .15-250 | .15-250 | .25-200 | 2-100 | 14-20 | A11 | fe | 7.95 |
| | TMO14-1 | 14 | .2-150 | .2-150 | .5-100 | 2-50 | 14-20 | A11 | fe | 8.45 |
| | FT1.22-1 | 1.22 | .005-100 | .005-100 | .01-50 | .05-25 | 14-21 | H16 | — | 35.95 |
| | FT1.5-1 | 1.5 | .1-400 | .1-400 | .5-200 | 1-100 | 14-21 | H16 | — | 35.95 |
| E  PRI SEC | FTB1-1 | 1 | .2-500 | .2-500 | .5-300 | 1-100 | 14-18 | H16 | — | 36.95 |
| | FTB1-6 | 1 | .01-125 | .01-125 | .05-50 | .1-25 | 14-18 | H16 | — | 36.95 |
| | ■ FTB1-1-75 | 1 | .5-500 | .5-500 | 5-300 | 10-100 | 14-18 | H16 | — | 36.95 |
| F  X Y Z | T-622 | 1:1:1 | 0.1-200 | 0.1-200 | 0.5-100 | 5-80 | 14-22 | ▽ | ff | 3.25 |
| | T-626 | 1:1:1 | 0.01-10 | 0.01-10 | 0.02-5 | .04-2 | 14-22 | ▽ | ff | 3.95 |
| | T2-613-1 | 1:1:2 | 0.07-200 | 0 07-200 | 0.1-100 | 0.5-50 | 14-22 | ▽ | fg | 1.95 |

NOTES:

* For functional configuration please see schematic drawings A and C on previous pages.

▽ Two case styles available: Plug-in case style X65; Radial lead case style W38.

✲ Insertion loss referenced to mid-band loss

★ Not DC isolated, insertion loss is measured with input at pin 1, output at pin 6, and pin 3, 4 are grounded.

■ Denotes 75 ohm model, for coax connector models 75 ohm BNC connectors are standard.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute power, voltage and current ratings:
   1a. RF input power: All models 0.25 Watt
   1b. DC current, 30mA

2. For TC, T, TT and TH series, operating temperature range is -20°C to +85°C.

### pin connections

see case style outline drawings

| PORT | fd | fe | ff | fg |
|---|---|---|---|---|
| PRIMARY DOT | 6 | 1 | X1 Y2 Z3 | X1 Y5 Z3 |
| PRIMARY | 3 | 6 | X6 Y5 Z4 | X2 Y6 Z4 |
| PRIMARY CT | — | — | — | — |
| SECONDARY DOT | 1 | 2 | — | — |
| SECONDARY | 3 | 6 | — | — |
| SECONDARY CT | — | — | — | — |
| CASE EXT. | 3 | 6 | — | — |
| CASE GND | — | 7,8 | — | — |
| NOT USED | 2,4,5 | 3,4,5 | — | — |



Mini-Circuits®
INTERNET http://www.minicircuits.com
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
Distribution Centers/ NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# QUICK RESPONSE
## TO SUPPORT YOUR APPLICATIONS

*...guides the customer through decision making on spec requirements...*

*...offer test procedures and statistical data...*

Our team of dedicated Applications engineers are prepared to respond courteously, promptly, knowledgeably and patiently to questions and challenges posed by customers.

Although Mini-Circuits offers a wide variety of over 1,000 signal processing components listed in the Designer's Guide, there is often a need to meet a spec somewhat different than one listed for a standard catalog item. In such instances, here is how our Applications engineer proceeds:

1) Customers will be asked to review a Specifications Check List for the component requested. This sheet guides the customer through decision making on spec requirements and the most critical parameters for the intended application.

2) Our Applications engineer will work with our Design Engineering team to check the feasibility of designing a new product to meet the specific spec; of course, if modification of an existing product is possible, this approach can slash development time and costs.

3) If the design is indeed feasible, samples will be fabricated and tested to insure they meet the intended design goals, then shipped to the customer for final evaluation in the intended application.

***Here is a brief summary of services available from our Applications Support team:***

•Respond to technical questions regarding specs and performance of catalog components and applications of our products.

• Although our published Computer Automated Performance Data (CAPD) is very comprehensive, we strongly urge our customers to request more detailed data when their application needs dictate a closer look at specific measurement points. Our enormous database on catalog and custom models is offered, at no extra charge, to eliminate any need for guesswork.

•Analyze customer specifications and recommend, wherever possible, a catalog component that provides the optimum cost/performance selection.

•Discuss in detail MIL-specs that may appear confusing to customers first encountering them. What they mean, definitions of terms, and how to be in conformance are explained.

•Correlate customer's test requirements with those of our Computer Test department.

•Review customer's environmental requirements and suggest, where applicable, cost-effective solutions.

•After determining critical parameters dictated for a customer's requirement, offer test procedures and statistical data to most effectively focus on those parameters.

•Keep customers aware of our latest new products during discussions of applications and new system designs.

•Interface with customers requesting Return Merchandise Approval (RMA). Quite often a courteous and thorough discussion relating to a component's failure to meet specs may be traced to improper test setup, poor matching, or other problems at the customer site. Suggested solutions often negate the need to return the product.

•Respond to customers requests for literature. Quickly send catalogs, notes, computerized test data, statistical data or new product data.

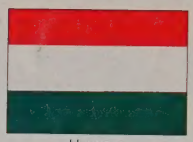
We encourage our customers to take full advantage of our Applications Support group's expertise. Contact us with any questions you may have, problems we may be able to solve for you, and assistance on recommending products in our catalog line or developing new designs for your next generation system. We promise a prompt, courteous, and perceptive response.

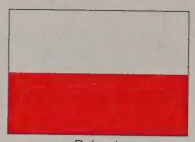
**Mini-Circuits®** P.O Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
*Distribution Centers* NORTH AMERICA 800-654-7949 • 417-335-5935 Fax 417-335-5945 EUROPE 44-1252-835094 Fax 44-1252-837010

# WORLDWIDE SALES OFFICES AND DISTRIBUTORS

United States Of America

Denmark


Hungary


Poland

Japan

Taiwan

Canada

Finland

Ireland

Spain

Singapore

Australia

Belgium

France

Italy

Sweden

Malaysia

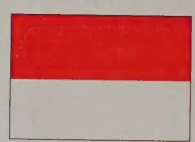
Israel

Luxembourg

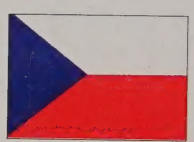
Germany

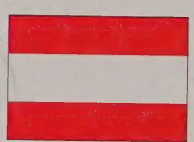
Netherlands

United Kingdom


Indonesia

South Africa


Czechoslovakia


Austria

Norway

India

Republic Of Korea

Brazil

## NORTH AMERICA

### *LOCAL REPRESENTATIVES*

**MID-ATLANTIC**
M.Lader Company
Columbia, MD 21045
(800) 442-3177

Gaithersburg, MD 20879
(800) 442-3177

Conshohocken, PA 19428
(800) 442-3177
(610) 825-3177

Fuquay-Varina, NC 27526
(800) 442-3177

Strasburg, VA 22657
(800) 442-3177
*74243.1313*
*@compuserve.com*

**MID WEST**
Cain-Forlaw Co., Inc.
Palatine, IL 60067
(847) 202-9898

Ft. Wayne, IN 46804
(219) 436-4466

Merriam, KS 66202
(913) 789-9896

Reynoldsburg, OH 43068
(614) 861-9500
*cfc@starnetinc.com*

**NEW ENGLAND**
Advanced Technology
Marketing Inc.
Chelmsford, MA 01824
(508) 458-0200
*atm@atmink.com*

**NEW JERSEY-NORTH**
**NEW YORK-METRO**
Spectrum Sales, Inc.
Syosset, NY 11791
(516) 921-5750
*ssi@li.net*

**NEW YORK-UPSTATE**
Robtron, Inc.
Skaneateles, NY 13152
(315) 685-5731
*102754.3454.*
*compuserve.com*

**NORTHWEST**
Cain-Sweet Co.
Aloha, OR 97006
(503) 591-0647

Bellevue, WA 98004
(206) 462-2118
*102707.464*
*@compuserve.com*

**SOUTHEAST**
Beacon Electronics
Associates
Huntsville, AL 35802
(205) 881-5031

Longwood, FL 32779
(407) 788-1155

Atlanta, GA 30328
(404) 256-9640
*beacon.info*
*@becon.com*

**SOUTHWEST**
Beacon Electronics
Associates
Round Rock, TX 78681
(512) 244-6675

Richardson, TX 75080
(214) 437-1505
*shields.connie*
*@becon.com*

**WEST**
N & S DAKOTA, MONTANA,
NEW MEXICO, UTAH,
EASTERN NEVADA
IRT
(800) 654-7949
*rm@minicircuits.com*

ARIZONA
Thorson Desert States Inc.
Scottsdale, AZ 85260
(602) 998-2444
*tdsiaz@aol.com*

CALIFORNIA-NORTH
Disman-Bakner
Mountain View, CA 94043
(415) 969-3010
*kay_armstrong*
*@dbsales.globalcenter*

CALIFORNIA-SOUTH
Youngewirth & Olenick
Tustin, CA 92680
(714) 838-5144
*contactus@yando.com*

COLORADO
GLX,Inc.
Englewood, CO 80112
(303) 771-3230
*glxa@aol.com*

**CANADA**
Cain-Sweet Co.
Burnaby, British Columbia
V3J 1R6 Canada
(604) 420-6886

Calgary, Alberta
T1Y 5R8 Canada
(403) 250-7288

Ottawa, Ontario
K2B 1A5 Canada
(613) 820- 2606
*102707.464*
*@compuserve.com*

••Giga-Tron Assoc. Ltd.
Ottawa, Ontario
K2E 7T 7 Canada
(613) 225- 4090
*sales@gigatron.com*

## INTERNATIONAL

### *EUROPE REPRESENTATIVES*

BELGIUM, LUXEMBOURG
▲Mini-Circuits Europe

CZECHOSLOVAKIA
▲Mini-Circuits Europe

DENMARK
Elmatok A-S
DK-5540 Ullerslev, Denmark
45 6535 1446

FINLAND
Integrated Electronics OY AB
SF-00440 Helsinki,Finland
358 0 586 1770
*marika@ieoy.fi*

FRANCE
Elexience
91371 Verrieres-le-Buisson
Cedex, France
33 1 69 53 8000

GERMANY
Municom Gmbh
D-83224 Grassau, Germany
49 8641 9585
*municom@dcinet.de*

GERMANY, AUSTRIA
••Industrial Electronics
D-65760 Echborn, Germany
49 6196 927900

HUNGARY
▲Mini-Circuits Europe

IRELAND
▲Mini-Circuits Europe

ITALY
Microelit S.P.A.
20146 Milan, Italy
39 2 4817900

00141 Rome, Italy
39 6 86894323
*microeli@mbox.vol.it*

NETHERLANDS
▲Mini-Circuits Europe

NORWAY
Datamatik, AS
N-1067 Oslo 10, Norway
47 22 30 17 30
*datamatik@sn.no*

POLAND
▲Mini-Circuits Europe

SPAIN
Ibercom S.A.
28709 Madrid, Spain
34 1654 1856

08014 Barcelona, Spain
34 1349 147 45

SWEDEN
Integrerad Electronik
S-161 11 Bromma,
Sweden
46 8 80 4685
*maggan@iekomp.se*

UNITED KINGDOM
▲Mini-Circuits Europe

### ASIA

JAPAN
M-RF Ltd.
Chlyodo-Ku, Tokyo, Japan
81 3 5821 3623

Osaka, 530, Japan
81 6 3137180
*cat02857@catline.or.jp*

••Densho Kaisha Ltd.
Minato-Ku. Tokyo, Japan
81 3 3436 0041

••Mini-Circuits Yokohama
Yokohama, 222 Japan
81 4 5545 1673

INDIA
Chithra Int'l.
Bangalore 560038, India
91 80 556 8310

SINGAPORE, MALAYSIA
INDONESIA
Precision Technologies
Henderson Industrial Park
Singapore 0315
65 2 734 573

SOUTH KOREA
R.F. High Tec Inc.
Seoul, Korea 139-052
82 2 999 4601/5

TAIWAN
Ameleks Corp.
Taipei, Taiwan ROC
88 6 275 86958

**AUSTRALIA**
Clarke & Severn Electronics
Hornsby NSW Australia 2077
61 2 482 1944

### MIDEAST

ISRAEL
**Mil-Ra'am Ltd.**
**Kfar Saba, Israel**
**972 9 7660550**

••Vitel Ltd.
Ramat-Hasharon, Israel
972 3 5490541

**SOUTH AFRICA**
ECS Electromagnetics
Bryanston 2021, S. Africa
27 11 805 4272

**NORTH AMERICAN DISTRIBUTION CENTER**
Mini-Circuits P.O. Box 7128 Branson, MO 65615
(800) 654-7949 • (417) 335-5935 • Fax (417) 335-5945
*lb@minicircuits.com*

*Industrial Accounts:*
Dept.D (800) 654-7949 Ext. 605

*Small-Order Accounts:*
Dept.F (800) 214-6428 Ext. 606

•• Distributor Only

Mini-Circuits®

**▲ DISTRIBUTION CENTER/LOCAL REP.**
Mini-Circuits Europe Dale House, Wharf Road
Frimley Green, Camberley, Surrey GU16 6LF, England
Phone 44 1252-835094 Fax 44 1252-837010